INITIAL STUDY

MANUFACTURED GAS PLANT INVESTIGATION INGERSOLL

SEPTEMBER 1989

Environment Ontario

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Minister

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MANUFACTURED GAS PLANT INVESTIGATION

INGERSOLL

Report prepared for:
Waste Site Evaluation Unit
Waste Management Branch

Report prepared by:
Conestoga-Rovers & Associates

SEPTEMBER 1989

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EXECUTIVE SUMMARY

Conestoga-Rovers and Associates (CRA) was retained by the Ministry of the Environment (MOE) to investigate the old manufactured gas plant site in Ingersoll, Ontario. The investigation was conducted in two phases. Phase 1 involved using non-intrusive geophysical methods and Phase 2 involved a drilling and sampling phase to ground truth the geophysical results.

The Phase 1 geophysical methods utilized included an electromagnetic and a magnetometer survey. The Phase 2 activities included the completion of sixteen boreholes on and off Site, with five of the boreholes being instrumented as observation wells. Air monitoring and soil sampling was conducted during drilling activities.

Subsequent to drilling activities four of the five observation wells were developed, monitored for water levels and sampled. The fifth well installed in a perched zone, identified during drilling, was dry. Groundwater samples were collected for the analyses of general chemistry parameters, trace metals, monocylic aromatic hydrocarbons (volatiles), naphthalene and benzo(a)pyrene.

The Site is generally separated into three geologic units: fill; sands and gravels; and limestone. The fill varies in thickness from 1.16 to

4.57 metres. The sands and gravels vary in thickness from 7.05 to 11.7 metres. The total average thickness of the overburden is 10.2 metres.

The groundwater flow in the overburden discharges to the Thames River. The horizontal groundwater velocity was calculated to be 0.53 metres/year in this unit. The travel time for groundwater in the overburden from the downgradient Site boundary to the Thames River, approximately 100 meters, was calculated to be in the order of 150 to 200 years.

Coal tar NAPL (refers to that portion of coal tar which is not dissolved in groundwater and can be visually identified as a separate and distinct material) saturated sands cover two-thirds of the Site and are known to extend off Site 25 metres. The coal tar NAPL saturated sands extend down to the top bedrock. Coal tar NAPL saturated fill is present to the north and west of Site. The full horizontal and vertical extent of contamination off Site was not determined.

Based on current conditions, the coal tar NAPL on Site is covered sufficiently to prevent exposure to the waste through existing on-Site activities. Existing data also indicates that the air quality above the Site has not been affected by the presence of coal tar.

The groundwater in the overburden on Site has been impacted by coal tar APL(refers to that portion of coal tar which is dissolved

in groundwater and cannot be visually identified as a separate and distinct material). The groundwater in the overburden is not used as a drinking water supply. The Town of Ingersoll gets its water suppy from communal municipal bedrock supply wells. The nearest communal well, which is approximately 140 metres deep, is located approximately 500 metres from the Site. Analytical data indicate that the well has not been impacted by coal tar related parameters. The well is a low yield standby well that is only used in periods of high water demand. The communal system consists of four wells, in addition to the standby well. The main producing wells are located a minimum of 1.5 km from the former coal gasification plant Site. The vertical gradient between the bedrock and the overburden sand and gravel unit has not been determined.

The full horizontal and vertical extent of the coal tar NAPL off Site has not been determined, however, is anticipated to be restricted to the vicinity of the Site. The likelihood of coal tar NAPL from the Site reaching the Thames River is extremely low.

It is recommended that the coal tar contamination (i.e. NAPL) found on and off Site be registered on the land title(s) and restrictions on future land uses be specified. Notwithstanding the foregoing, future work, including additional boreholes, observation wells and groundwater and potentially surface water sampling is recommended to be completed on and off the Site.

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1.1 BACKGROUND

Conestoga-Rovers & Associates (CRA) was retained by the Ministry of the Environment (MOE) to investigate the old manufactured gas plant site in Ingersoll, Ontario. The Site location is presented on Figure 1.1 and the Site layout, both historic and current, is presented on Figure 1.2.

The objectives of the investigation were to:

1) determine if gasification plant wastes remain on Site;
2) if wastes are on Site, determine their context and distribution;
3) if wastes are on Site, determine if there are contaminants off Site or potential for off-Site migration; and
4) If wastes are present (on or off Site), determine if there is existing threat to human health or the environment.

To meet the above objectives, the investigation was conducted in two phases.

Phase 1 involved a geophysical survey to determine if there were any buried wastes and/or storage vessels remaining at the Site. Phase 1 activities are discussed in Section 2.0.

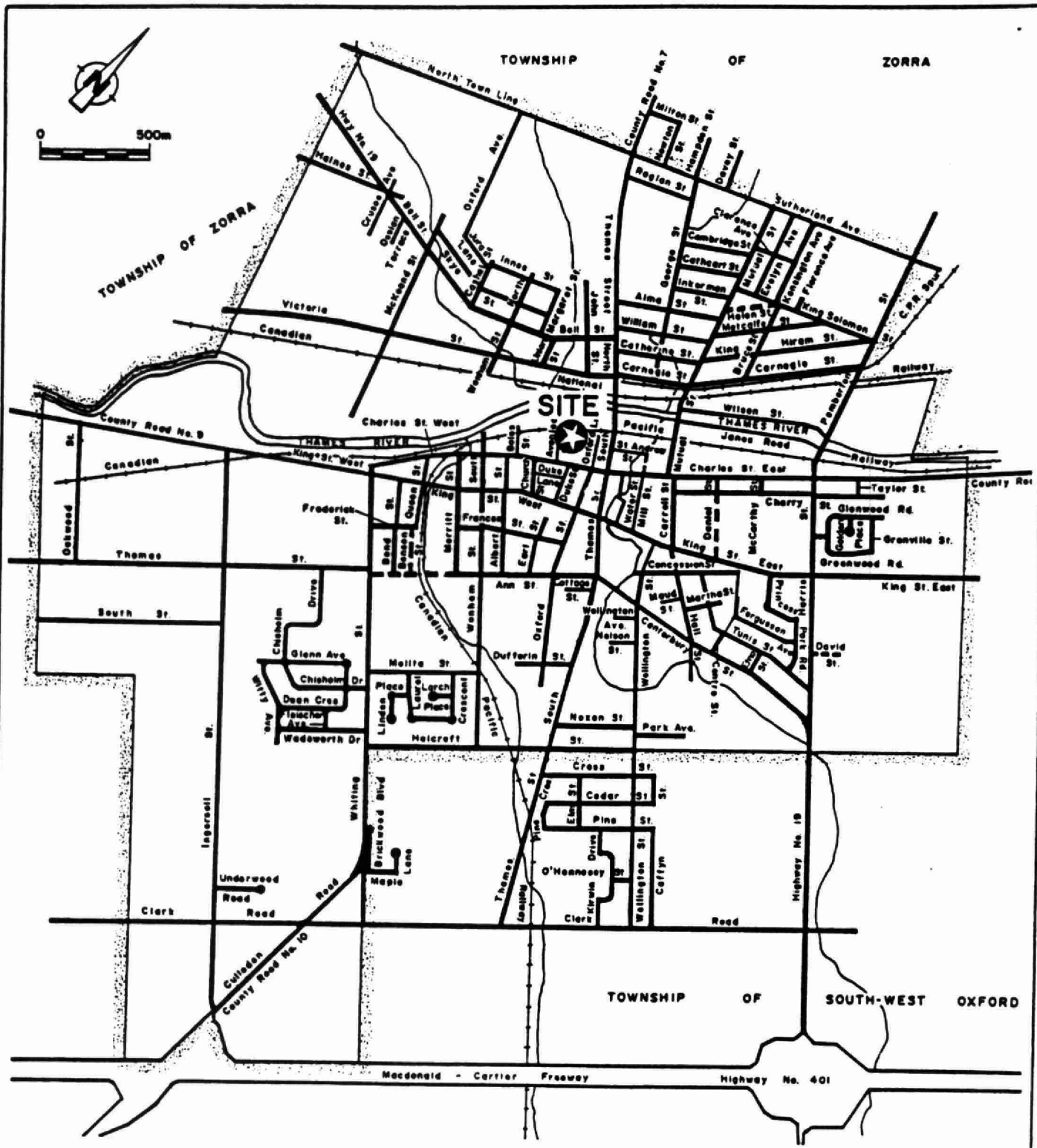

figure 1.1

LOCATION PLAN
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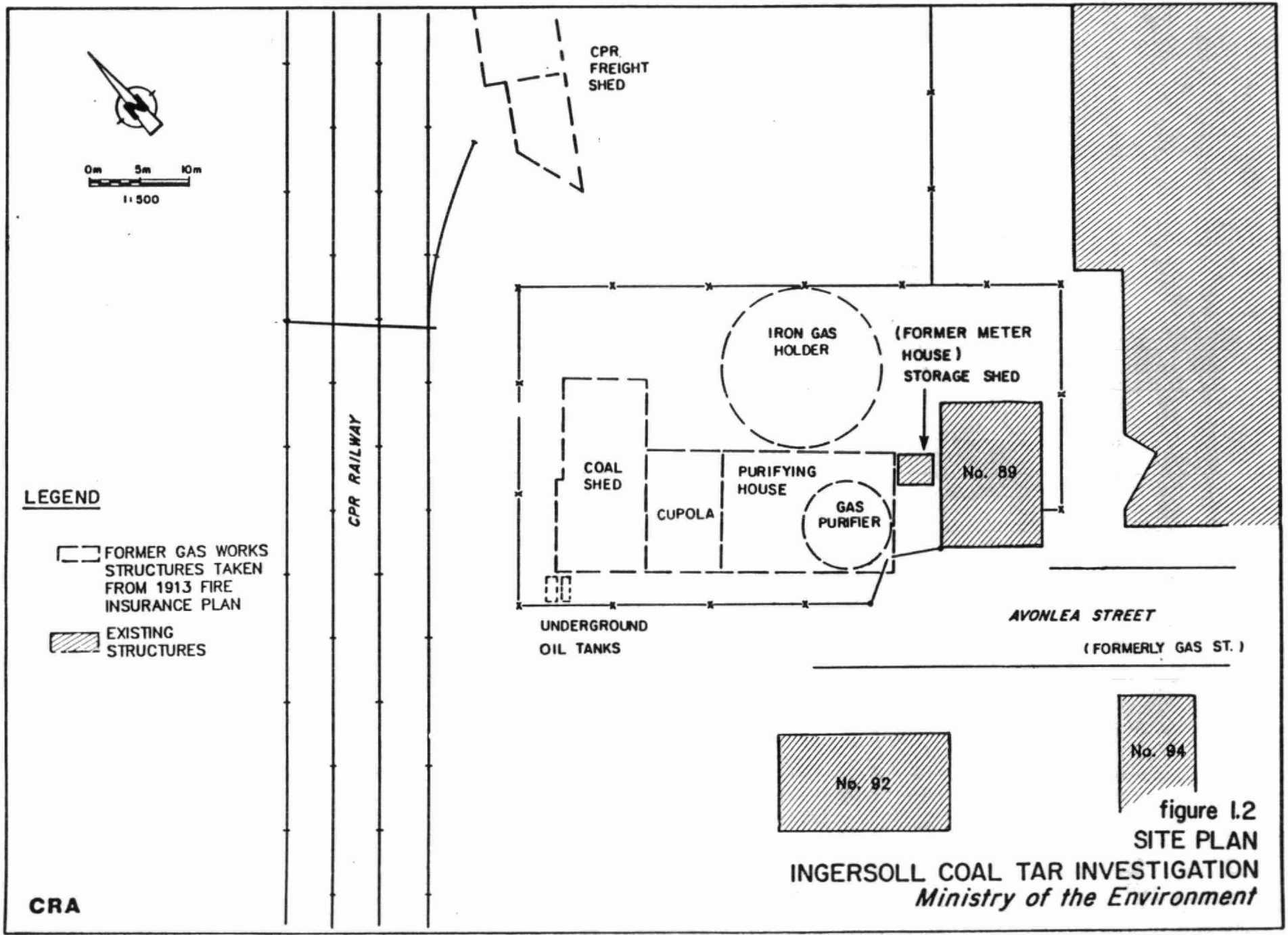

figure 1.2
SITE PLAN
INGERSOLL COAL TAR INVESTIGATION
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Phase 2 involved drilling, soil sampling,air monitoring, observation well installation, well development and groundwater sampling to ground truth the geophysical results and to determine the extent of gasification plant wastes on Site. Phase 2 activities are discussed in Section 3.0.

Section 4.0 presents an evaluation of the geologic/hydrogeologic conditions at the Site, and addresses the extent of visual contamination encountered at the Site.

Section 5.0 presents all the analytical data obtained during the investigation and an assessment of the data.

Section 6.0 presents recommended additional work required in order to better define the limits of visual contamination in the vicinity of the Site and data required to complete an evaluation of the threat to human health or the environment.

1.2 SITE HISTORY

According to record (Intera, 1987), the Ingersoll Gas Works operated between the period 1876 to 1915. The Gas Works operated from a small, 0.2 hectare site located at 83 Avonlea Street (formerly Gas Street), immediately southeast of the Canadian Pacific Railway tracks, approximately 100 meters southeast of the Thames River. The Gas Works were operated for

their duration under the name of the Ingersoll Gas Light Company, which was incorporated in 1876. According to the 1913 Fire Insurance Plan of the area, the structures composing the Ingersoll Gas Works consisted of a Coal Shed, Purifying House, and Cupola. Two circular gas holders were also located on-site, as were two underground oil storage tanks on the northwest corner of the Coal Shed (see Figure 1.2). Immediately east of the Gas Works was the former Canadian Pacific Railway Freight Shed and, to its east, the C.W. Reilly Cold Storage building. Lands to the south of the Gas Works consisted mainly of commercial establishments while property to the west was vacant and apparently unused.

Additional documentation concerning the operation and management of the Ingersoll Gas Works, particularly as it relates to production, distribution and by-product disposal facilities, both on-site and off, is difficult to obtain as any documentation which may have existed has apparently been either destroyed or misplaced. Three advertisements for information, one each placed in the Woodstock Daily Sentinel-Review for the week of March 18, 1988 and the Ingersoll Times for the same week, as well as a bulletin posted in a local senior citizen's home, failed to attract any responses.

While conducting site investigations, CRA learned from an elderly citizen of the area that a well of approximately 5 feet in diameter was at one time present on the site of the former Gas Works. No evidence of this well was observed during the Site investigations. It is speculated,

however, but not confirmed, that this well was probably a dug well completed in the shallow sand and gravels on site (see Section 4.2).

Additionally, it was learned that the former Gas Works experienced a large explosion in approximately 1915 which apparently resulted in its ultimate demise. It is not known whether the Gas Works was operational at the time of the explosion.

The former metering house is the only remaining structure of the former Gas Works. It is of concrete block construction, and is currently used as a storage shed. The door to this building is locked at all times. It should be noted that the 1913 Fire Assurance Plan of the former Gas Works does not locate the metering house.

2.0 PHASE 1- GEOPHYSICAL SURVEY

The objective of the geophysical survey was to determine if there were any buried wastes and/or storage vessels remaining at the Ingersoll Site. A review of the local geology as well as past information on the Site provided by Intera (1987) assisted in the selection of the geophysical methods utilized at the Site. The methodology and results of the surveys are outlined below.

2.1 METHODOLOGY

A 20-foot (6-metre) interval sample grid spacing was established prior to undertaking the geophysical surveys. Easting and northings were assigned to each location. The perimeter of the grid was delineated by flagging tape for future reference and the established grid was infilled by pacing. The grid for the geophysical surveys is presented on Figure 2.1.

The shallow sensing Geonics EM31 electromagnetic instrument was chosen for the terrain conductivity survey to map the bulk conductivity of the earth materials to a depth of approximately 4.5 metres. The electromagnetic (EM) instrumentation is designed to detect terrain conductivity by utilizing a current flow induced in the subsurface materials by a surface transmitter. An alternating electric current produced in the transmitter coil generates an alternating magnetic field. The magnetic field

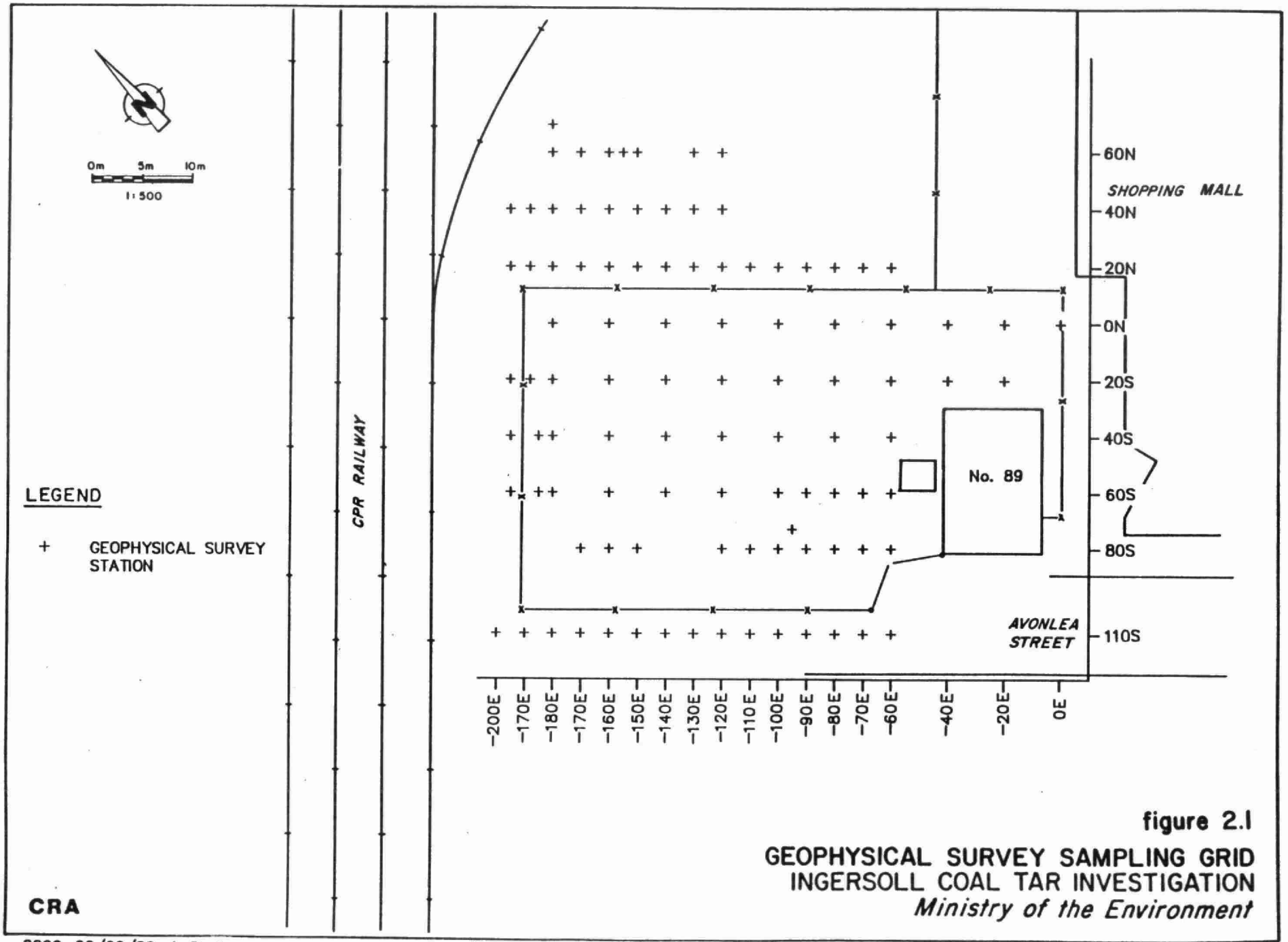

figure 2.1

GEOPHYSICAL SURVEY SAMPLING GRID
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penetrates the ground surface and induces current flow through the earth materials which in turn induces a secondary magnetic field. The secondary magnetic field sensed at the receiver coil depends on the strength of the primary field, current frequency, distance between transmitter and receiver coils (factor considered constant for the EM31), and the presence of a conductive body. The EM31 is portable permitting data to be collected rapidly and continuously as the operator and the instrument move across the land surface.

The Geonics EM31 instrument has transmitter and receiver coils separated by a rigid boom 3.6 metres in length. The device reads in milliSiemen per metre (mS/m). Generally the conductivity obtained with the EM31 will vary smoothly from one region to the other. In some cases, however, as for example where a well defined vertical contact separates a poor conductor from a very good conductor, edge effect may be seen in which the readings vary rapidly with position and are no longer a good indicator of terrain conductivity. This effect is often evident in areas where several metallic (ferrous) pipes and/or vessels are intersected along the line of traverse. The EM also suffers loss of detection ability when the soil's electrical conductivity rises above 40 mS/m. This response is characteristic of soils with high clay and/or water content.

The bulk conductivity of the earth materials is influenced by such factors as moisture content, geological composition, stratigraphy, and the presence of contaminants. The EM31 has been used to locate buried

drums, pipes, cables, cavities and tunnels, as well as in the mapping peat thickness and the extent of leachate plumes.

Magnetometers can also be utilized to detect perturbations in the geomagnetic field created by buried ferromagnetic objects such as steel tanks and pipes. The magnetometer can detect buried metal objects at depths much greater than a metal detector. The most common instruments currently in use are the gradiometric and the proton precession magnetometers. The proton precession magnetometer typically measures the magnetic susceptibility of the total field. That is to say that it is capable of sensing both the vertical and horizontal field components. The gradiometric magnetometer has the advantage in being able to sense the vertical field component while remaining relatively insensitive to the horizontal field component. This feature allows the instrument to sense subsurface targets in the presence of anthropogenic interferences such as steel fences.

The magnetometer is portable permitting data to be collected rapidly and continuously as the operator and the instrument move across the land surface. In soils with minimum interference, individual steel containers, for example, can easily be detected to a depth of 3 metres. No problems are evident with the magnetometer survey being conducted in a cohesive soil. Problem could arise with the EM in cohesive soils due to the usual high water content and soil inhomogeneity. The McFar Fluxgate Magnetometer (MAG) is a gradiometric magnetometer used in the search work at the Ingersoll Site.

The use of two different methods concurrently at the Site makes data interpretation easier, particularly under difficult Site conditions. Comparison of data from the two techniques yields more information and confidence in the evaluation of Site conditions. The results of the geophysical surveys were used to most appropriately site boreholes during the Phase 2 investigations at Ingersoll.

A computer aided "nearest neighbor" mapping package was used to store, manipulate and present the EM and MAG data. The nearest neighbor package is the simplest search method that finds the nearest neighboring data point, in an Euclidean (geometric) distance sense, regardless of their angular distribution around the point being estimated. This method is fast and satisfactory if control points (instrument readings) are distributed in a comparatively uniform pattern and is based on the intuitively appealing idea that a nearby observation point is a better estimate of the value of a point on a surface than a more distant one, and that a small number of nearest control points provide essentially all the information that is relevant to the estimate.

2.2 GEOPHYSICAL SURVEY RESULTS

The EM31 was operated continuously using the inphase component with measurements taken at 6-metre (20-foot) intervals and any anomalous readings observed between stations recorded at their actual substation. Readings were taken with the instrument both parallel and

perpendicular to the main anthropogenic feature of the Site, a steel fence running the length of the Site. The results of the EM31 survey for Ingersoll are presented in Appendix A. The normalized EM31 survey results are presented in Figure 2.2.

The average value for the parallel and perpendicular readings were used for the data reduction. Background readings were obtained five metres north of the CPR tracks. In displaying the EM31 data, the ratio of the surface conductivity to background conductivity represented in equal logarithmic units, was utilized. Decibel (db) units were multiplied by 20 to give convenient whole numbers and were contoured. The "0 db" contour outlines background data, and a contour interval of 2 db portrays successive factors of about 0.8 above the background conductivity.

The MAG survey was conducted on the established grid upon completion of the EM31 survey. The instrument was operated continuously and any anomalous readings observed between stations were recorded at their actual substation. The results of the MAG survey are also presented in Appendix A and on Figure 2.3. An average background reading of 2300 gammas was determined for the MAG survey.

Due to the nature of the Site and its relatively small size, interferences on the two surveys conducted, from several large anthropogenic sources were noted. These objects included the frost fence surrounding the Site, a car body, a camper trailer, assorted piles of metal pipes and bath-tubs, metal building (No. 89 Avonlea St.), the CPR tracks northwest of the Site and

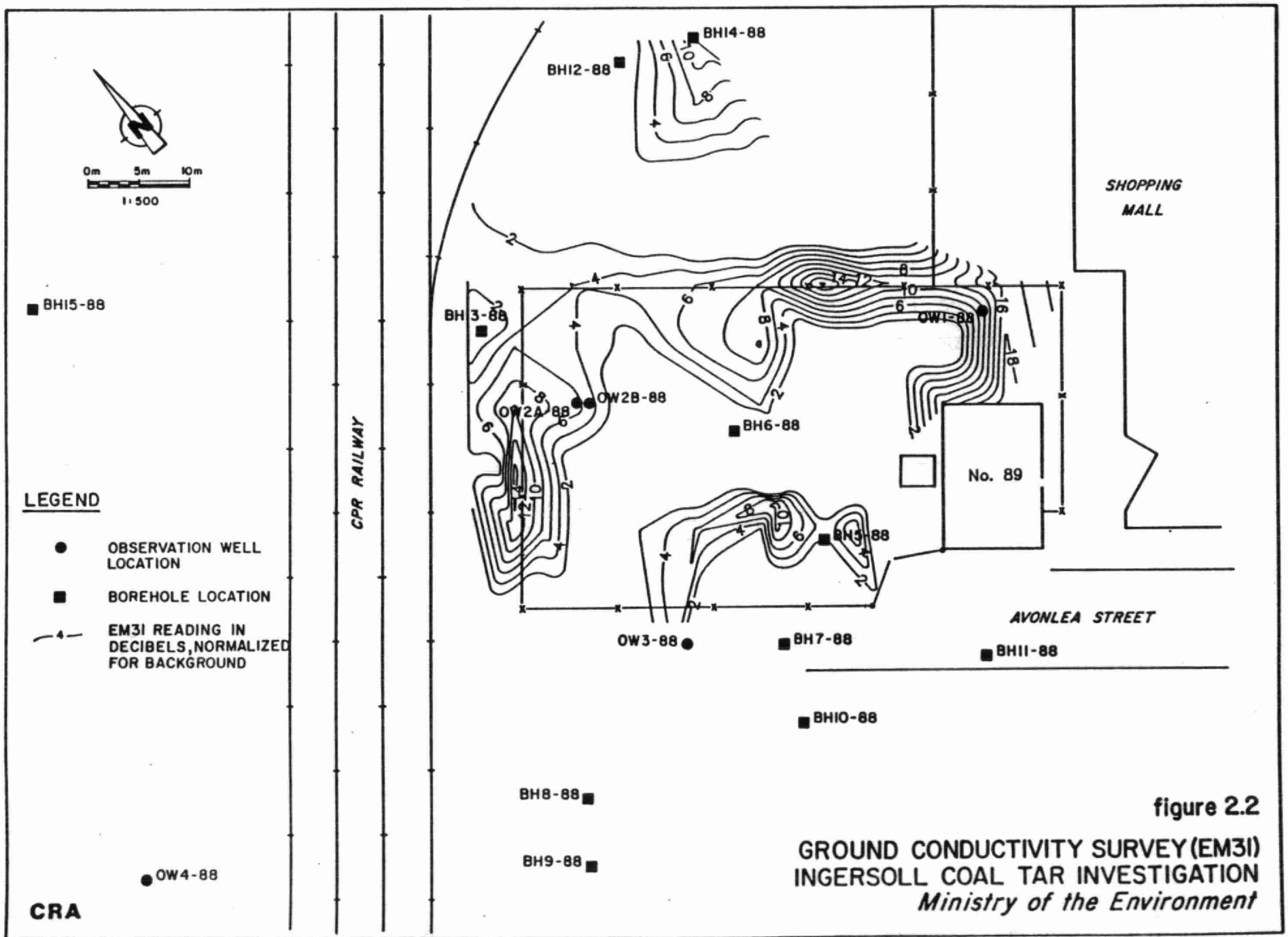

figure 2.2

GROUND CONDUCTIVITY SURVEY (EM31)
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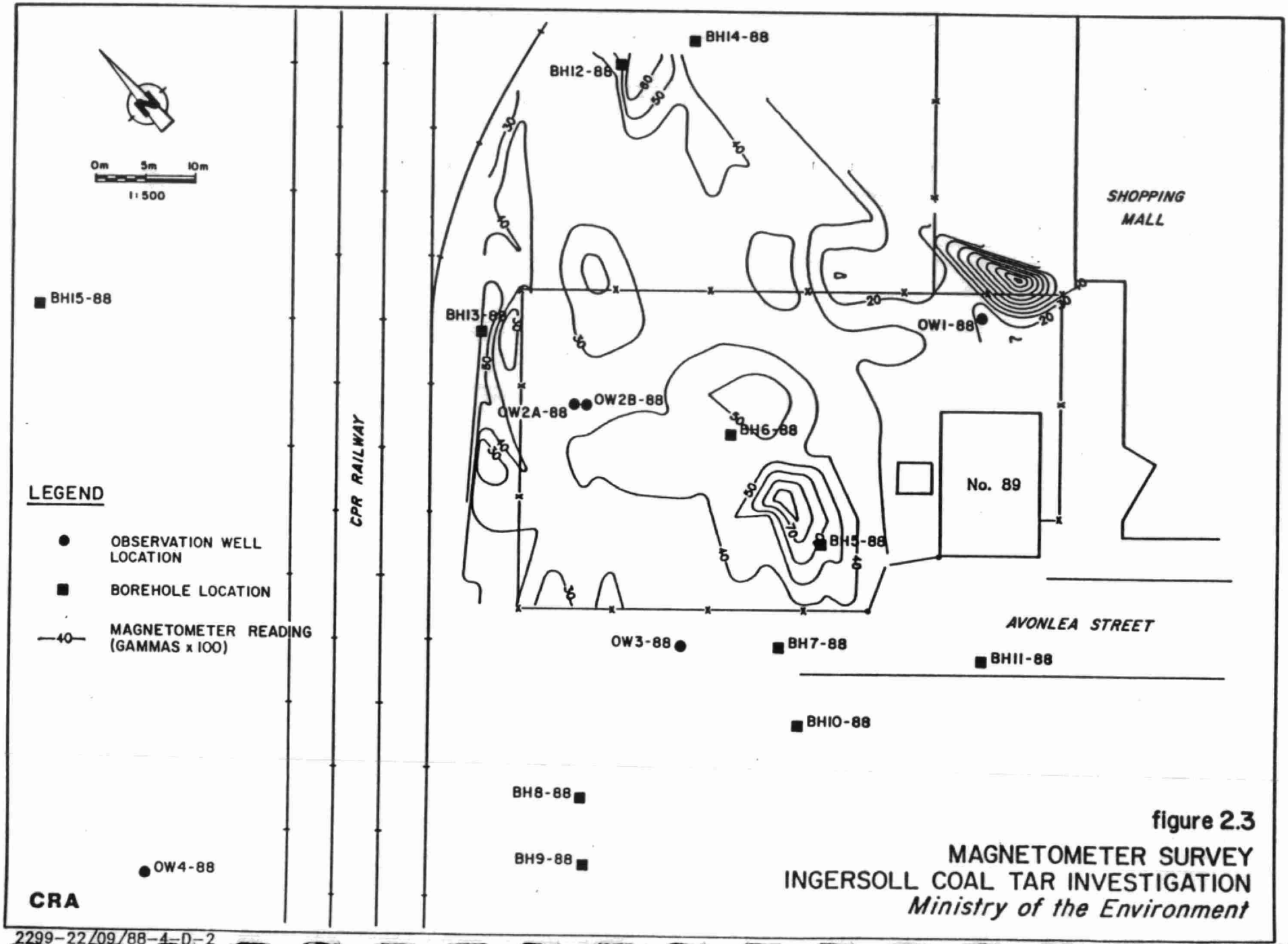

figure 2.3

MAGNETOMETER SURVEY
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several smaller metallic object. Chain link fences and buried pipes tend to increase the conductivity measured, but these features are linear or elongated and the instrument can often be oriented to minimize their interference. The influence of the chain link fence on the EM31 results is evident

A review of Figures 2.2 and 2.3 indicated that there were several potential drill site locations within the assumed boundaries of the Site. It was determined that a location north-east of the building at No. 89 Avonlea St. would be indicative of background conditions at the Site. Anomalous readings in this area were interpreted as being the result of the surrounding metal building and fence. The most probable location to intercept a buried vessel and/or contamination was determined to be 10 metres north of the access gate. An additional anomaly was noted 25 metres north of the access gate in the vicinity of BH6-88.

In order to secure additional background readings for the Site, several small lines were run northeast of the Site along CPR property. The anomalously high values in this area were not expected as there was no waste metal present on ground surface. The resemblance of the high conductive anomaly to those observed within the assumed Site boundaries indicated that this area warranted further investigation. This work was beyond the original scope of investigation. Subsequently, discussions were held with CPR, the MOE and CRA, and it was determined that an extended investigation (i.e. drilling program) of the geophysical anomaly in this area should be conducted. The extended drilling program conducted in this area is discussed in Section 3.1.2.

3.0 PHASE 2 - SUBSURFACE FIELD ACTIVITIES

Field activities undertaken during Phase 2 included: drilling; soil sampling; observation well installation; well development; and, groundwater sampling.

The drilling program at the Ingersoll Site was designed to provide geologic and hydrogeologic data to ground truth the geophysical results and to determine the presence and extent of coal tar contamination on Site. Local stratigraphy was determined from the borehole logs, and piezometers were installed to determine the groundwater levels and provide water samples for chemical analysis. Details of the drilling program conducted at the Site are summarized below.

3.1 DRILLING AND MONITORING WELL INSTALLATION

3.1.1 Initial Drilling Program

The initial drilling program for Phase 2 activities was conducted between March 7 and March 9, 1988 by the drilling division of Environmental Systems Canada (ESC). Six boreholes (OW1-88, OW2A-88, OW2B-88, OW3-88, OW4-88 and BH5-88) were advanced using a truck-mounted Mobile B-61 drilling machine equipped with 6-5/8 inch (168 mm) Internal Diameter (I.D.) hollow stem augers. Soil samples were collected

continuously to completed depth. Prior to mobilizing to the Site, the drill rig and all associated tooling was decontaminated.

The decontamination procedures consisted of a thorough steam cleaning of the rig and all associated equipment prior to mobilization onto the Site to remove oil, grease, mud, etc. Subsequently, before initiating drilling at each borehole or observation well location, the augers, cutting bits, samplers, drill steel and associated equipment were cleaned to prevent cross-contamination from the previous drilling location. The cleaning was accomplished by flushing and wiping the components to remove all visible sediments followed by a thorough high pressure wash and rinsing. The split spoon and continuous sampler were further cleaned by a methanol/deionized water rinse. All rinse liquids were containerized for future disposal (see Section 3.6.2).

At each drilling location, a temporary work zone was established with the dirty work zone being demarcated as an exclusion zone. Within the exclusion zone, all work related to soil sampling was carried out by personnel equipped with appropriate personal protective equipment (PPE) at a minimum level equivalent to USEPA level "C" with the exception that half-face respirators were worn only when the working environment warranted them (see Section 3.3). Establishment of the exclusion zone included covering the ground in the immediate area with 3 mil plastic sheeting and plywood, on which all work was conducted.

Real-time air monitoring was conducted using portable photoionization detector (HNu), and by an olfactory survey. The meter used is sensitive to the volatile components of coal/oil tar including the aromatics and naphthalene in the 1 ppm range, but is not specific as to which are present. CRA periodically monitored downwind of the Site during the drilling operations to determine if organic vapours were migrating off-Site. Air monitoring conducted at the Site is discussed in Section 3.3.

The drilling program commenced in an area assumed to be representative of background conditions as defined by the geophysical surveys and progressed in sequence from assumed clean to dirtier areas. Upon completion of each hole, all augers and sampling equipment were thoroughly decontaminated. Each sampler was cleaned between samples as well.

As drilling progressed, the soil samples were visually examined by a CRA geological technologist and classified according to the Unified Soil Classification (Wagner, 1957). Soil samples collected were placed in glass jars for future reference and/or chemical analysis. Obviously contaminated drilling spoils were sequestered and drummed for later disposal (see Section 3.6.1). The remaining drilling spoils were used as backfill. Boreholes which were not instrumented with observation wells were backfilled to ground surface with cement/bentonite grout.

The observation wells were placed through the stem of the augers. Well construction materials primarily consisted of 50 mm

diameter threaded flush joint schedule 80 PVC with 50 mm diameter #10 slot screens. Due to the extent of contamination encountered at OW3-88, this well was completed with a 50 mm diameter stainless steel well screen and black iron pipe (BIP) riser. The borehole annulus around each screen was filled with a graded sand pack to approximately 0.6 metres above the top of the well screen. A bentonite pellet seal, approximately 0.6 metres thick, was placed above the sand pack. The remainder of each well was then backfilled to ground surface with cement/bentonite grout. The observation wells installed within the boundaries of the fence were not supplied with protective casings. The two observation wells which lie outside of the fenced area were installed with lockable protective casings, complete with padlocks.

Following completion of the observation wells and boreholes, all wells and boreholes were surveyed by CRA personnel for horizontal and vertical control. The Town of Ingersoll provided a reference datum point at the top of the fire hydrant located at the west side of Thames Street and south of the CPR tracks.

3.1.2 Extended Drilling Program

Following discussions with CPR, the MOE and CRA, an extended drilling program was conducted in order to define the geophysical anomaly northeast of the Site, on CPR lands, as well as to define the areal extent of contamination encountered along Avonlea Avenue. This

investigation was limited to the installation of exploratory boreholes and was beyond the original scope of the investigation.

The extended drilling program for Phase 2 activities was conducted on March 28, 1988 and March 29, 1988 by the firm of At-Cost. Ten boreholes (BH6-88 through BH15-88) were advanced using a Nodwell mounted Mobile B-16 drilling machine equipped with 4-1/4 inch (108 mm) I.D. solid stem augers. Soil samples were obtained off the auger flights. Prior to commencing the work at the Site, the drill rig and all associated tooling was thoroughly decontaminated as outlined in Section 3.1.1. Upon completion of each hole all augers were thoroughly decontaminated as outlined in Section 3.1.1.

An exclusion zone was established at each drilling location. All work related to soil sampling was carried out by personnel equipped with appropriate personal protective equipment (PPE) at a minimum level equivalent to USEPA level "C" with the exception that half-face respirators were worn only when the working environment warranted them (see Section 3.3). Establishment of the exclusion zone included covering the ground in the immediate area with 3 mil plastic sheeting and plywood, on which all work was conducted. Real-time air monitoring was conducted using an HNu meter. Air monitoring conducted at the Site is discussed in Section 3.3.

As drilling progressed, the soil samples were visually examined by a CRA geological technologist and classified according to the

Unified Soil Classification. Soil samples collected were placed in glass jars for future reference and/or chemical analysis. Obviously contaminated drilling spoils were sequestered and drummed for later disposal (see Section 3.6.1). The remaining drilling spoils were used as backfill. The boreholes were grouted to surface with bentonite.

Following their completion, the boreholes were surveyed by CRA personnel for horizontal and vertical control.

3.1.3 Drilling Program Summary

Sixteen boreholes in total were completed at the former gasification plant and surrounding properties. These locations are shown on Figure 3.1.

Six boreholes were advanced, five of which were instrumented with observation wells, during the initial drilling program: OW1-88, OW2A-88, OW2B-88, OW3-88, OW4-88 and BH5-88. The boreholes for wells OW1-88, OW2A-88, OW3-88 and OW4-88 were advanced to the limestone bedrock. The bedrock could not be penetrated with an auger rig. The borehole for well OW2B-88 was advanced to the top of a silt seam, as discussed subsequently in this section, and the borehole for BH5-88 was advanced to the bottom of void encountered at this location (see Section 4.2.1).

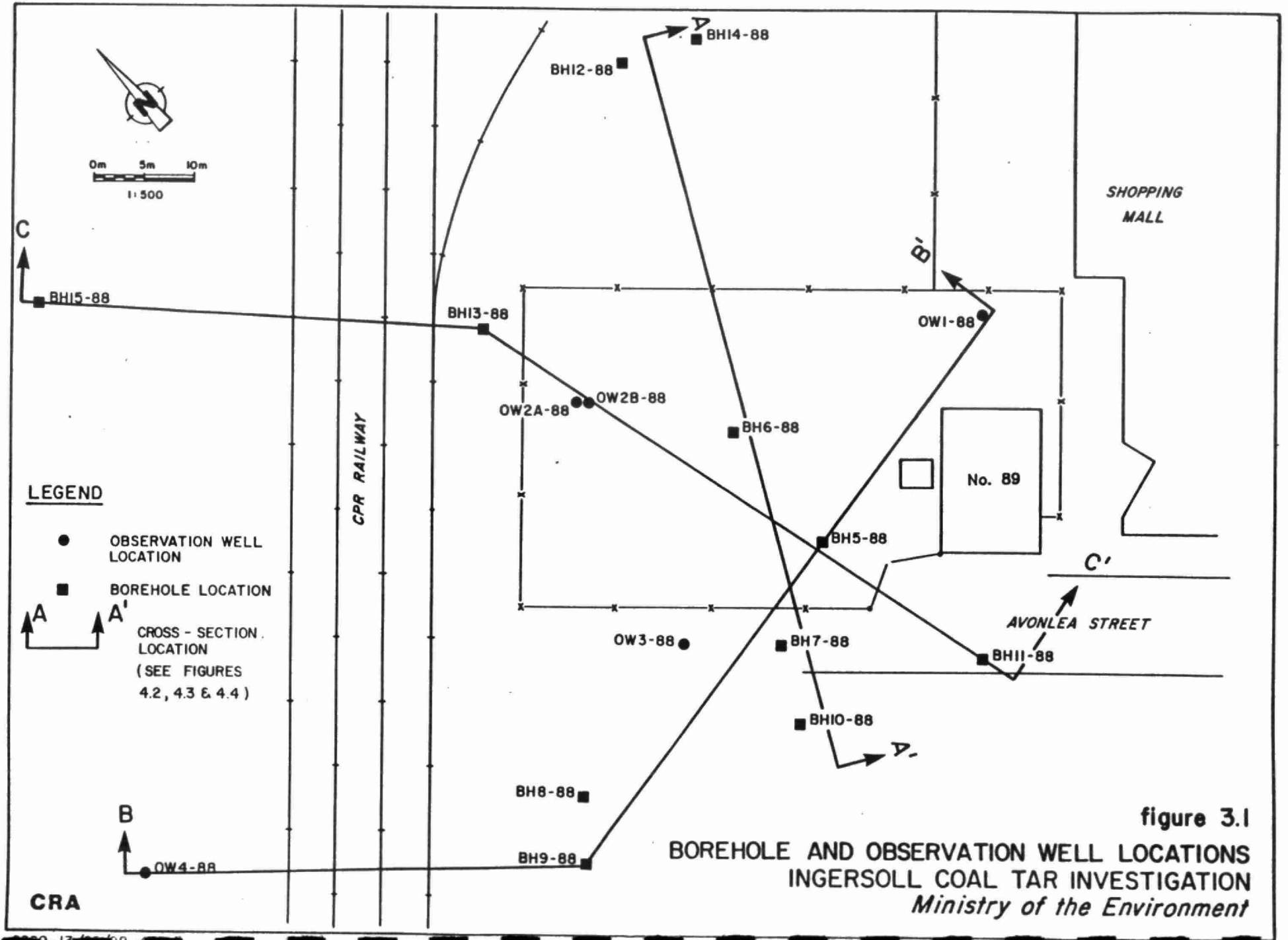

figure 3.1

BOREHOLE AND OBSERVATION WELL LOCATIONS
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Ten boreholes were advanced during the extended drilling program: BH6-88 through BH15-88. The boreholes were advanced to the top of bedrock unless contamination was encountered.

The five boreholes were instrumented with observation wells (during the initial program) to determine the position of the water table, the direction of groundwater flow, and provide water chemistry data. Observation wells OW2A-88 and OW2B-88 were completed as a nested installation. OW2B-88 was installed to monitor the perched water identified, during drilling, directly above a silt seam, and OW2A-88 was installed directly above bedrock. This area was characterized by high EM31 readings and background MAG readings. The anomalous EM31 readings are the result of the presence of the silt layer. The silt layer appears to be restricted to the northern corner of the fenced property. Observation well OW3-88 was installed along the Avonlea Avenue right-of-way in order to investigate an anomaly identified by the EM31 survey (Figure 2.2), emanating from the Site. Three boreholes, BH5-88, BH13-88 and BH14-88 were completed in areas characterized by both EM31 and MAG anomalies which could not be accounted by surface features.

Observation well construction details are summarized in Table 3.1. Copies of stratigraphic and instrumentation logs for observation wells and boreholes are presented in Appendix B.

TABLE 3.1

WELL CONSTRUCTION DETAILS

Well #	Date Completed	Ground Elevation (m AMSL)	Top of Pipe Elevation (m AMSL)	Total Depth (m BGS)	Screened Interval		Screened Unit
					Depth (m BGS)	Elevation (m AMSL)	
OW1-88	7 Mar 88	271.18	271.999	13.3	7.62-9.14	263.6-262.0	fine sand
OW2A-88	8 Mar 88	269.89	270.891	11.0	9.45-10.97	260.4-258.9	sand/gravel
OW2B-88	8 Mar 88	270.34	271.007	4.8	3.05-4.57	267.3-265.8	silt fill
OW3-88	9 Mar 88	269.81	270.802	11.0	9.14-10.06	260.7-259.8	medium sand
OW4-88	9 Mar 88	266.68	267.382	8.3	4.57-6.10	262.1-260.6	sand/gravel

3.2 SOIL SAMPLING

As discussed in Section 3.1, soil samples were collected continuously to completed depth of the boreholes. Soil samples collected for stratigraphic definition were placed in precleaned glass jars and transported to CRA's warehouse in Waterloo, Ontario for future reference. Selected samples, as discussed in Section 5.2, were chosen for waste characterization, to confirm the identity of the waste, and were submitted to OceanChem Group of Dartmouth, Nova Scotia (OceanChem).

3.3 AIR MONITORING

Site boundary, exclusion zone breathing space, auger stem, and sample bottle head space, air monitoring was conducted during the initial drilling program, using an HNu meter. The unit was calibrated daily using 64.2 ppm butane calibration gas.

During drilling, air monitoring was conducted periodically or when a PAH odour was noticed. HNu readings in the auger stems and the breathing space within the exclusion zone were monitored and recorded. Criteria for determining the level of health and safety adhered to during drilling is summarized on Table 3.2.

Site boundaries were also monitored to detect any migration of aromatics from the Site as a result of drilling operation. No

TABLE 3.2

HEALTH AND SAFETY CRITERIA

WORKING ENVIRONMENT	HNu (1) READING	HEALTH AND SAFETY LEVEL	PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED (2)
No Hazards	1.0-5.0	Level D - intermittent air monitoring	Coveralls, cotton gloves, hard hat, steel toe work boots
Suspected Unknown Hazards	5.0-15.0	Level C - intermittent air monitoring	Tyvek coveralls, latex surgical gloves, nytrel butel gloves, half face respirator complete with acid gases & organic vapour cartridges
Known Hazards	>15	Level B - continuous personal air monitoring	Saranex coveralls, inner latex gloves, outer nytrel butyl gloves taped to coveralls, full face respirator with supplied breathing air (SCBA), hard hat, steel toe work boots

Notes: (1) HNu reading measured in breathing space
(2) Health and Safety Protocols developed by and utilized by CRA

noticeable discharges were evident as all readings along the fence lines, were considered to be background (ranging from 1.0-1.5 ppm).

Headspace within sample jars were recorded when obvious contamination was noted in soils. Upon encountering PAH contamination in the soil, the sample was placed in a precleaned glass jar and a reading of the headspace within that jar was recorded.

HNu readings were also taken within the storage shed on Site (former metering house) and the levels of volatile organics were equivalent to background readings.

The basements of the two most westerly houses, located on Avonlea Street (see Figure 1.2), adjacent to the Site were surveyed using the HNu meter. No noticeable PAH vapours were present and all readings were equivalent to background readings.

3.4 WELL DEVELOPMENT

All observation wells installed during this program were developed to ensure that the hydraulic and chemical data obtained from each well was representative of formation conditions. Development was performed using a top-loading copper bailer attached to a stainless steel leader and a length of nylon rope. New nylon rope was used at each well. Prior to

use in each well, the bailer was cleaned using a methanol/deionized water rinse.

A minimum of three well volumes of water was removed from each of the wells or until three consecutive and consistent readings of conductivity and pH were obtained. A summary of well development information is presented on Table 3.3.

All development water and rinse water was collected and containerized in drums on Site for later disposal (see Section 3.6.2).

3.5 GROUNDWATER SAMPLING

Subsequent to the completion of well development activities, a complete set of groundwater samples were collected from the observation wells on March 23, 1988. Groundwater samples were collected with the bailer utilized for well development. Subsequent to well development and prior to sample collection the bailer was cleaned using a methanol/deionized water rinse. A blind duplicate sample and a bailer rinsate sample were also collected to provide quality control on the sampling program.

Groundwater samples were collected for the analyses of the parameters summarized on Table 3.4. Samples were generally poured directly from the bailer into the appropriate sample container. Samples for

TABLE 3.3

WELL DEVELOPMENT SUMMARY

Well No.	Date Developed	Three Well Volumes (liters)	Volume Purged (liters)	pH	Conductivity (umhos/cm)
OW1-88	3/22/88	12	12	7.07 7.27 7.05 7.19	1500 1500 1540 1580
OW2A-88	3/22/88	30	12	7.00 7.02 7.05 7.03	2130 2210 2240 2270
OW3-88	3/22/88	21	12	7.30 7.08 7.05 7.00	1600 1610 1600 1600
OW4-88	3/22/88	18	12	7.37 7.35 7.22 7.24	770 740 730 720

TABLE 3.4

WATER ANALYSIS PARAMETER LIST

PH (field)

Calcium (Beak)
Magnesium (Beak)
Sodium (Beak)
Potassium (Beak)

Trace metals (Beak) by DCP scan: Al, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Sr, V, Zn

Alkalinity (CRA)
Bicarbonate (CRA)
Sulfate (CRA)
Sulfite (CRA)
Chloride (CRA)
Thiocyanate (CRA)
Ammonium (CRA)
TKN (CRA)
COD (CRA)
TOC (Beak)
Phenols (CRA)

Volatiles (Novalab): monocylic aromatic hydrocarbons which include benzene, toluene, xylenes, ethylbenzene

PAHs (Novalab): naphthalene, benzo(a)pyrene

metals analysis were field filtered using a 0.45 micron filter (millipose aseptic or equivalent) prior to transfer to the sample container. Sample containers for metals and thiocyanate analyses were preserved with HNO_3 (to pH<2) and NaOH (to pH>12), respectively. The sample containers were then packed on ice for storage and shipped to the appropriate laboratory (see Table 3.4) for analyses. Throughout sample collection and shipping, chain-of-custody procedures were employed.

3.6 WASTE MATERIAL HANDLING

3.6.1 Soil Cuttings

During drilling, visually contaminated drilling spoils, personnel protection equipment and any wastes generated as a result of drilling activities, were sequestered and drummed. The drummed waste was stored on Site, within the fenced enclosure behind the building at No. 89 Avonlea St., and was further delineated with caution tape. All drum lids were securely fastened.

On July 13, 1988, under the supervision of CRA personnel, a total of nine 45-gallon (205-litre) drums containing wastes, were loaded onto a flatbed trailer for off-Site disposal at Tricil Ltd. in Carunna, Ontario. A copy of the MOE manifest for the wastes is presented in Appendix C.

3.6.2 Wash Water and Development Water

All wash waters and development waters generated during the Site investigations, were collected and drummed. The drummed waters, approximately 410 litres (90 gallons) were stored on Site, with the soil cuttings, as discussed in Section 3.6.1.

According to the MOE guideline, "Management of Waste Contaminated Soils at Abandoned Coal Gasification Sites", water collected from coal tar waste sites may be discharged to municipal sanitary sewers provided discharge requirements are met. Benzo(a)pyrene (BAP) is the recommended indicator parameter for calculating discharge requirements of the waters. The maximum allowable concentration of BAP discharged to the sanitary sewer from coal gasification sites is required to be calculated to ensure that the additional incremental concentration of BAP in sewage treatment plant effluent is not increased by more than 10 ppt (0.01 ug/L).

Based on the MOE guideline, the maximum discharge rate of the waters to the sanitary sewer was calculated to be 35 litres per minute (see Appendix D). The discharge rate was calculated based on an average sewage treatment plant flow rate of 1,250,000 gpd (3,950 litre/min), solubility limit of BAP in water of 3.8 ug/L and a treatment plant removal efficiency for BAP of 70 percent.

Based on the total volume of waters at the Site (410 litres), and the discharge rate of 35 litre/min., the discharge of waters was calculated

to require a minimum discharge period of twelve minutes. Upon review of the discharge flow rates discussed above, the MOE's Operations Officer for the sewage treatment plant in Ingersoll, requested that the time period calculated for discharge be doubled.

On July 13, 1988, the total volume of waters on Site (410 litres) were discharged to the westerly most sanitary manhole (MHW8) on Avonlea Street. The waters were discharged over a total time period of 30 minutes, thereby satisfying the MOE guidelines and the additional request of the MOE's Operations Officer.

4.0 GEOLOGIC/HYDROGEOLOGIC EVALUATION

4.1 REGIONAL SETTING

4.1.1 Regional Geology

The Town of Ingersoll is located in the Oxford Till Plain Physiographic region (Chapman and Putman, 1966). The region is characterized by drumlins and flutings which have a northwest alignment. The till sheet mantling much of North and West Oxford Townships is identified as the Zorra till. This till is a very stiff, commonly fissile, stony, silt or sand till, which is locally quite clayey near its base (Cowan, 1975). The till is usually less than 6 metres thick. The Zorra till is thought to have been laid down by an advance of the Huron lobe and perhaps following the advance of the Lake Erie lobe, the last active glacier at the end of the Wisconsin glaciation, which deposited the Port Stanley till.

The Oxford Till Plain Physiographic region is also crossed by three well marked valleys cut by glacial meltwater streams. The South Branch of the Thames River, an underfit stream, occupies a deeply incised glacial meltwater channel that cuts across the till plain at Ingersoll. This valley was partly infilled with glaciofluvial outwash sands. The glaciofluvial deposits occurs as sand and gravels in terraces along the major meltwater channels (Cowan, 1975). The sorting of these deposits are highly variable. The sands vary from very coarse to fine in mean grain size and are poorly sorted to well sorted. The major terrace deposits along the South Branch of

the Thames River occur at an elevation less than 15 metres above the modern floodplain. The ancient rivers, by cutting away the overburden from the bedrock have made the quarrying of the limestone bedrock in the Beachville area possible.

Modern alluvium is mapped adjacent to the the water courses in the region. These deposits consist predominantly of gravels, silts and sands. In the major stream valleys these deposits are usually less than 3 metres thick. Along the Thames River, the alluvium consists of sand and gravel derived from reworked till or gravel (Cowan, 1975).

The total thickness of the glacial overburden in Ingersoll varies from 9.4 to 12.2 metres along the Thames River valley and from 16.2 to 34.7 metres along the till plain as determined from the available water well records. Generally, the thickness and nature of the deposits in the Ingersoll area change rapidly and the deposits are predominantly discontinuous.

Rocks of Middle Devonian age form the bedrock in the area. The Lucan Formation, of the Detroit River Group, consists of limestone and dolomite which dip to the southwest. The Detroit River Limestones are quarried for the production of high-quality calcium limestone for lime, crushed stone and fluxstone at Beachville located to the east of Ingersoll.

4.1.2 Regional Hydrogeology and Groundwater Use

The study area is located southeast of the Thames River. The river system appears to work as a discharge zone for the extensive deposits of sand and gravel located along its banks. The influence of the river to the regional bedrock aquifer has not been established.

The absence of ponds and lakes in the area may indicate that the surficial materials are permeable. A swampy area south of Ingersoll may indicate a local groundwater discharge zone and/or perched water conditions.

The Town on Ingersoll gets its water supply from communal municipal bedrock supply wells. A total of nine municipal supply wells are located within and in near vicinity the town. The wells are completed within the limestone of the Detroit River Group. Groundwater flow within the bedrock is generally north to south. Under pumping conditions, flow will converge on the major pumping centres. The locations of the wells are presented on Figure 4.1 and their logs are provided in Appendix E. Of the nine municipal supply wells located in Ingersoll, seven are registered as holders of Permits to Take Water with the MOE. These permits are also provided in Appendix E.

Four wells are currently not active (September 1988). Well #4, located north of the Thames River, was taken out of production as a result of nitrate contamination (personal communications, MOE). Well #9 is

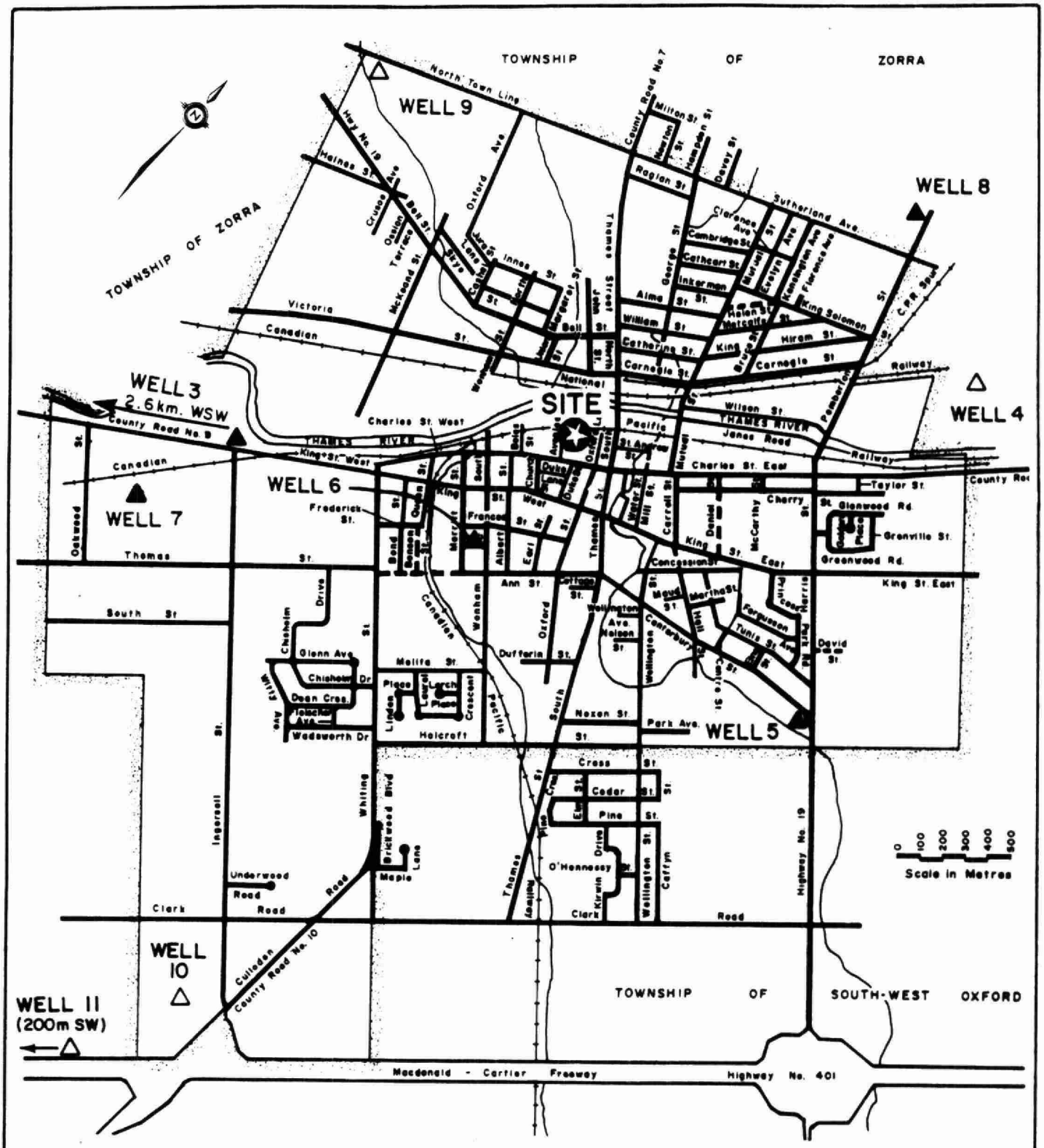

figure 4.1

LOCATION OF MUNICIPAL SUPPLY WELLS
INGERSOLL COAL TAR INVESTIGATION
Ministry of the Environment

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not functional. Well #10 and Well #11, situated near the CAMI plant immediately north of Hwy 401, were scheduled to be put into production in early October, 1988.

The average pumping rate for each municipal well was calculated over a seven month period (January to July, 1987, inclusive) and these rates are presented on Table 4.1. These wells can collectively produce up to approximately 1,390 gpm (105 l/s), (personnel communication, PUC). Interference effects have not been observed at other wells during controlled Aquifer Tests (IWS, 1977).

The supply well located closest to the former gasification plant is Well #6, at Pump House 2. Well #6 is located approximately 500 metres south of the former gasification plant. The well is a low yield standby well that is used only in periods of high water demand. Based on the average pumping rate for Well #6, the bedrock underlying the former gasification plant may be within the recharge area of this well. The vertical gradient between the bedrock and the overlying sands and gravels at the site was not determined within the scope of this investigation. The estimated capture zones of the remaining wells, located a minimum of 1.5 km from the site, do not incorporate the area of the former gasification plant.

The apparent transmissivity of the bedrock aquifer has been determined from Aquifer Tests on the municipal wells. The average transmissivity is in the range of 298 m^3/day (IWS, 1977). A bulk hydraulic conductivity of 3.9×10^{-3} cm/sec has been calculated using the open hole in

TABLE 4.1

AVERAGE MUNICIPAL WELL DISCHARGE

WELL NUMBER	PUMP HOUSE NUMBER	AVERAGE WELL DISCHARGE (gpm) *
3	5	247
5	4	432
6	2	29.8
7	6	38.5
8	7	135

NOTE:

* Average pumping rate calculated from January to July 1987, inclusive.
Average bedrock transmissivity= 20,000 gal/day-ft (298 m3/day)
(IWS, 1977)
Precipitation available to groundwater system= 100,000 gal/day/mi2
(IWS, 1977)

the bedrock of the production well. It should be noted, however, that the groundwater in the limestone bedrock occurs along fractures and solution channels and the bulk hydraulic conductivity may be lower than the hydraulic conductivity of the producing interval.

Much of the upper part of the Thames River basin is covered with thin deposits of sand and gravel which, where saturated are exploited by numerous shallow wells, however, the shallow sands and gravels are not utilized as a source of drinking water in the Ingersoll area.

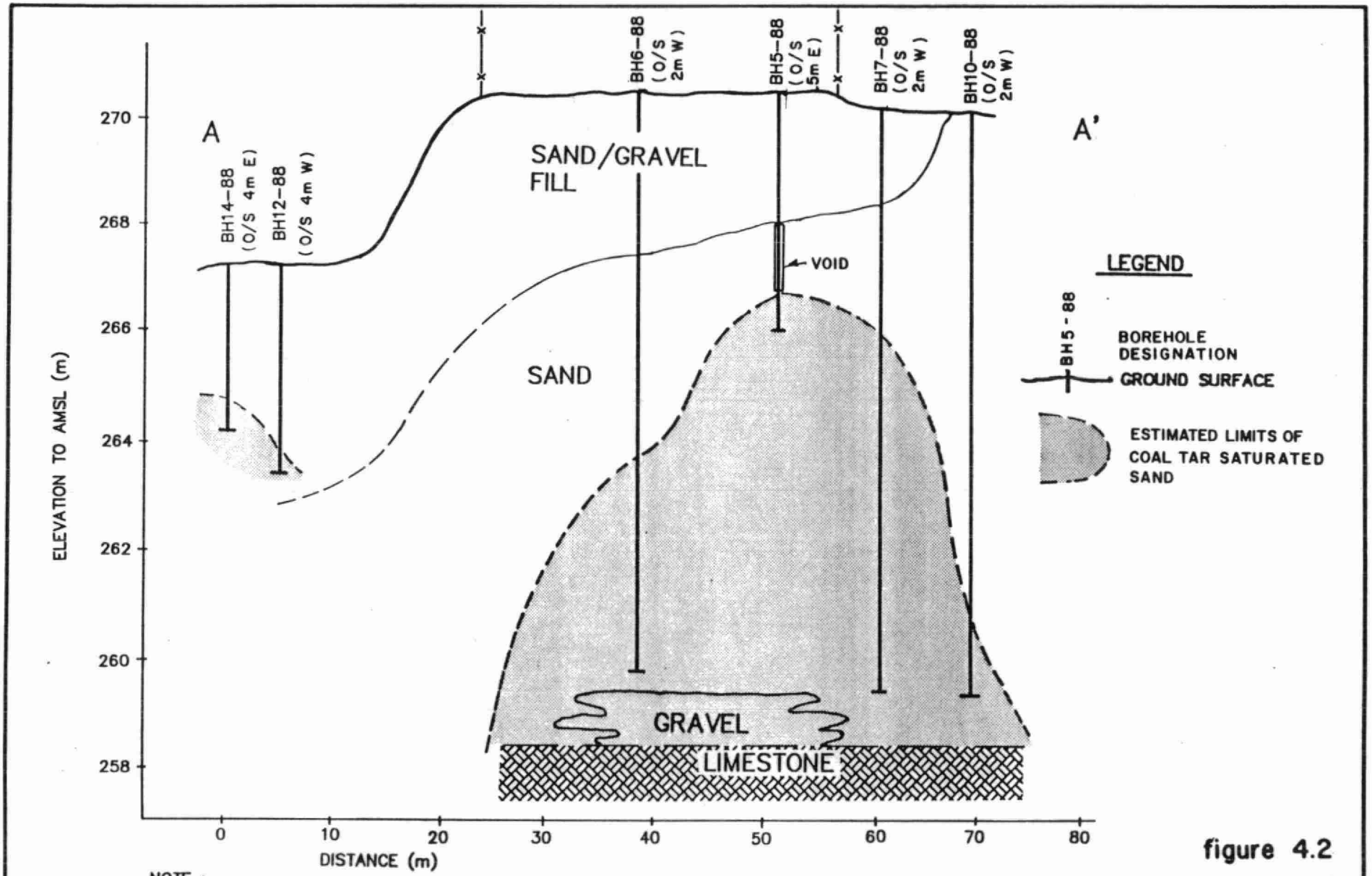
4.2 SITE DESCRIPTION

4.2.1 Site Geology

The following description of the site geology is interpreted from boreholes drilled during this study. The site can be generally separated into three geologic units. These units are:

1. Fill
2. Sands and gravels
3. Limestone

The distribution of the stratigraphic units at the site are shown on three cross-sections presented on Figure 4.2, 4.3 and 4.4. The locations of the cross-sections are shown previously on Figure 3.1. The



NOTE :
(1) BRICKS PRESENT IN FILL AT BH14-88 AND BRICKS, COAL & WOOD PRESENT IN FILL AT BH5-88.
(2) VOID ENCOUNTERED BETWEEN ELEV. 268 AND 266.75 m AMSL AT BH5-88, CONCRETE (SLAB ?) ENCOUNTERED IMMEDIATELY BELOW VOID.

figure 4.2

SECTION A-A'
INGERSOLL COAL TAR INVESTIGATION
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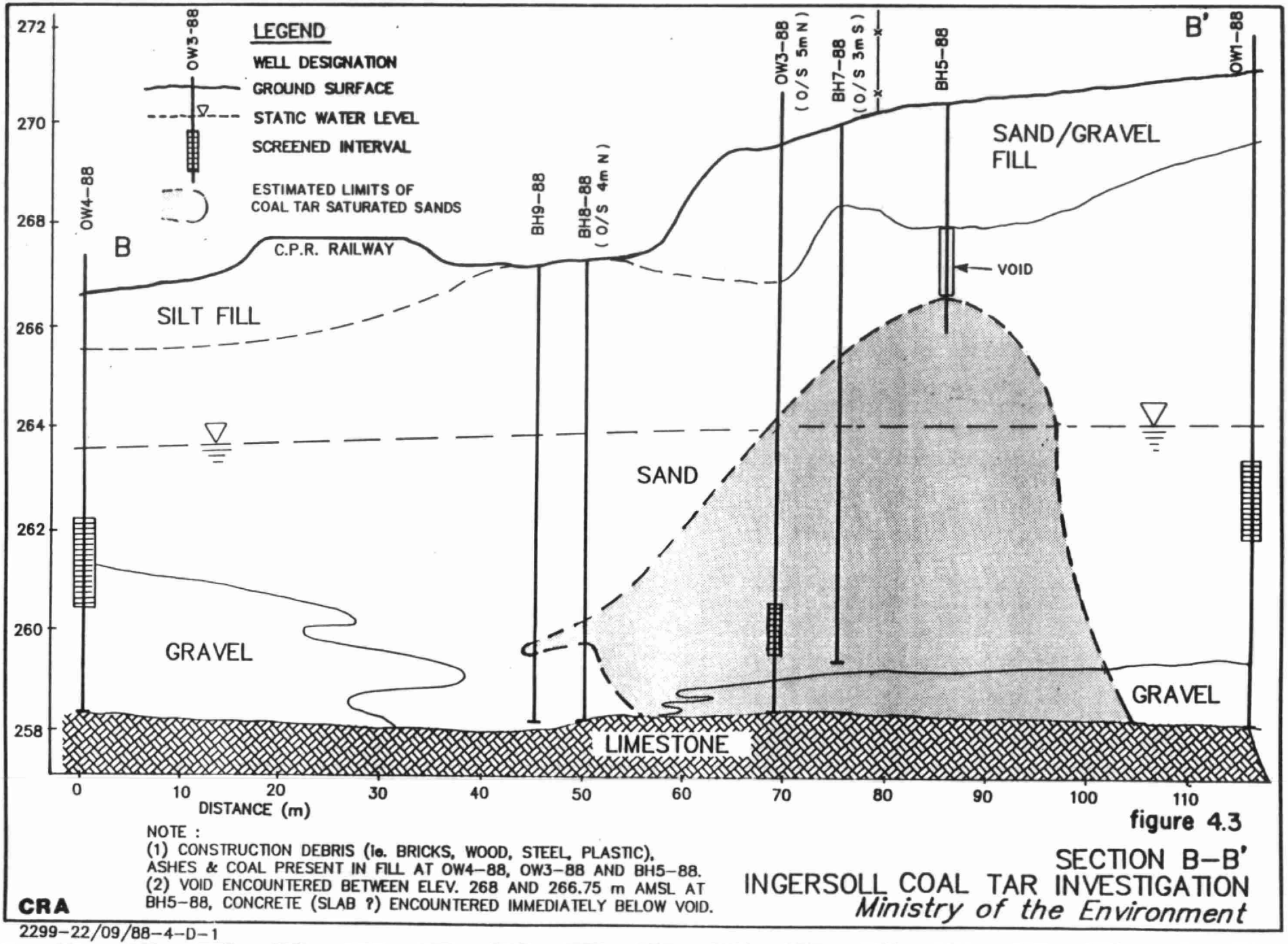

figure 4.3

NOTE :
(1) CONSTRUCTION DEBRIS (ie. BRICKS, WOOD, STEEL, PLASTIC), ASHES & COAL PRESENT IN FILL AT OW4–88, OW3–88 AND BH5–88.
(2) VOID ENCOUNTERED BETWEEN ELEV. 268 AND 266.75 m AMSL AT BH5–88, CONCRETE (SLAB ?) ENCOUNTERED IMMEDIATELY BELOW VOID.

SECTION B–B'
INGERSOLL COAL TAR INVESTIGATION
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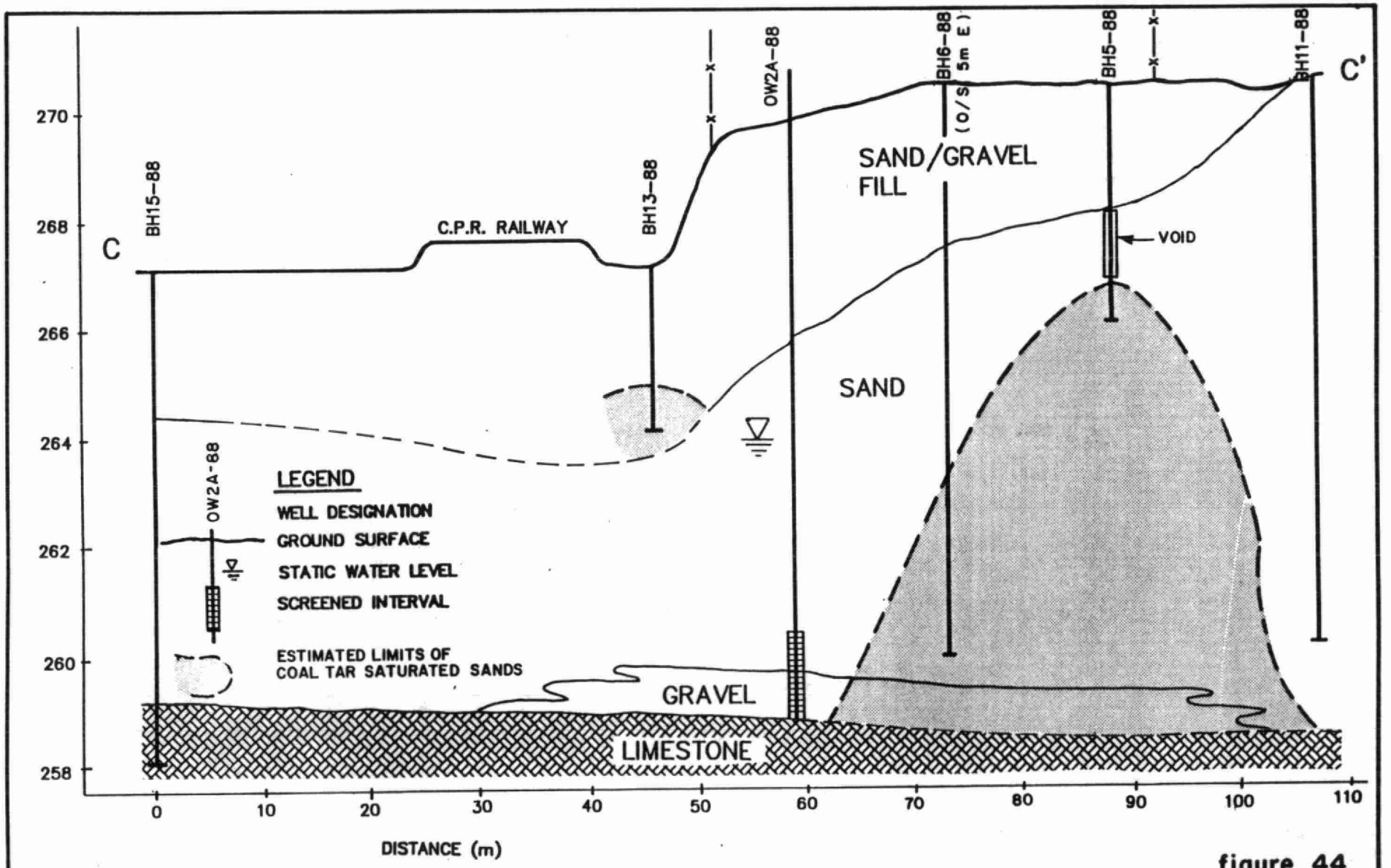

figure 4.4

SECTION C–C'

INGERSOLL COAL TAR INVESTIGATION

Ministry of the Environment

NOTE :
(1) CONSTRUCTION DEBRIS (ie. BRICKS, WOOD, STEEL) & COAL PRESENT IN FILL AT OW2A–88, BH5–88, BH15–88.
(2) VOID ENCOUNTERED BETWEEN ELEV. 268 AND 266.75 m AMSL AT BH5–88, CONCRETE (SLAB ?) ENCOUNTERED IMMEDIATELY BELOW VOID.

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various stratigraphic units are described below. It should be noted that BH6-88 through BH15-88 were installed using a solid stem auger in order to determine the areal extent of contamination. Samples were collected off the auger flights and as a result the descriptions are not as detailed as for samples collected by the continuous sampler or by the split spoon.

Fill

The uppermost unit across the entire site is fill. The fill consists of sand and gravel with some silt. The material is well graded, brown, moist and often penetrated by roots in the upper one metre. Bricks, wood chips and steel were also encountered in the fill. The fill varies in thickness from 1.16 to 4.57 metres. The thickest fill deposits were encountered along the CP lands northeast of the fenced area at BH14-88 and within the fenced area at BH5-88. During the drilling of BH5-88 it was noted that the augers began to spin freely from 2.44 m to 3.65 m below ground surface. BH5-88 was located within limits of a former iron gas holder. Video taping of the inside of the void indicated what appeared to be a 10 inch line running toward the steel shed on the property. The steel shed is probably the former gas distribution shed and was the only building left standing after the explosion which levelled the remainder of the gasification plant. The cavern was infilled with approximately 4.2 m^3 of 0.4 MPa cement. The weak grout mixture was utilized because it can be easily excavated with a backhoe if need be, and yet strong enough to support the weight of a truck.

Sands and Gravels

The sands and gravels encountered below the fill are glaciofluvial deposits which occur in terraces along the major meltwater channels. The sorting of these deposits are highly variable. The unit varied from a dense fine uniform sand to a poorly sorted sand layered with silt to a well graded gravel. The gravels predominantly occurred at depth overlying the limestone bedrock at OW1-88, OW2-88, OW3-88 and OW4-88. The total thickness of the gravels varies from 2.96 to 0.31 metres. However, given that the gravels do not appear to be continuous beneath the site, they are not identified as a separate geologic unit.

The total thickness of the sand and gravel unit varies from 7.05 to 11.7 metres.

Limestone Bedrock

Bedrock was encountered at 6 of the 15 boreholes installed at the site. The bedrock consists of a very hard limestone which could not be penetrated by the auger rig. A contour map of the top of the bedrock is presented as Figure 4.5. In the study area, the bedrock surface generally slopes gently to the east and to the west from a central high located at OW2-88 and BH15-88. Regionally the bedrock slopes to the southwest.

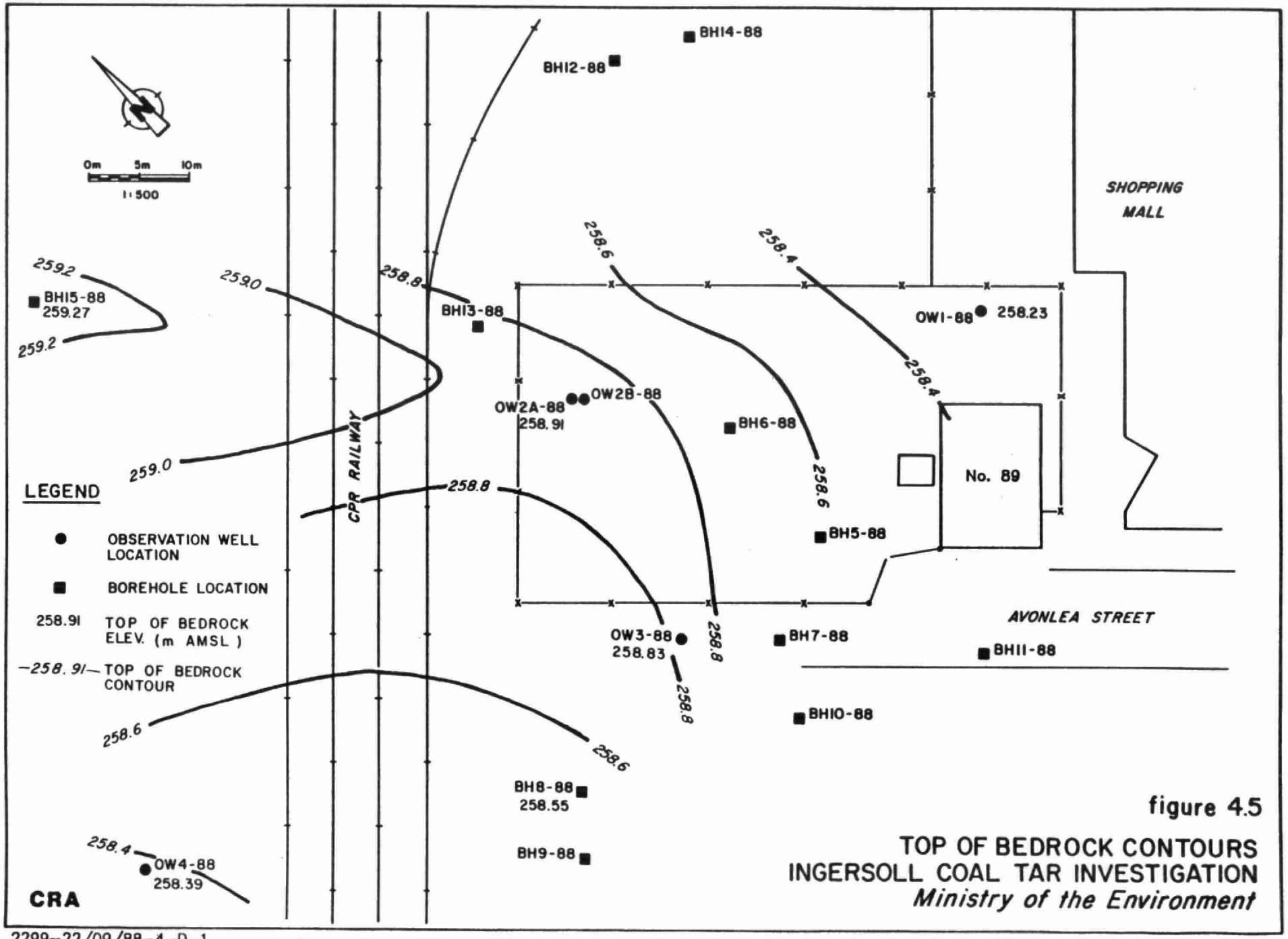

figure 4.5

TOP OF BEDROCK CONTOURS
INGERSOLL COAL TAR INVESTIGATION
Ministry of the Environment

4.2.2 Site Hydrogeology

The hydrogeological investigation of the Ingersoll Site is limited to the unconsolidated deposits overlying the limestone bedrock. The limestone bedrock could not be penetrated using auger drilling techniques. The bedrock aquifer is utilized as a source of groundwater at Ingersoll.

The water level data obtained March 23, 1988 have been contoured and are illustrated on Figure 4.6. The groundwater flow in the sand and gravel unit is directed to the west toward the Thames River. The elevation (approximately 263 m AMSL) of the Thames River indicates groundwater flow from this unit discharges to the river.

Perched water was identified directly above a silt seam at location OW2-88. The 0.88 metre thick silt seam is located approximately 4.82 metres below ground surface. Two installations were completed at this location, one directly above the uppermost confining layer in the perched water (OW2B-88) and the second was installed directly above bedrock (OW2A-88). The uppermost well, OW2B-88, remains dry.

Although the sorting of the sand and gravel unit is variable, a representative hydraulic conductivity of this unit would be in the order of 10^{-4} cm/sec. Based on the water table contours presented on Figure 4.6, the horizontal gradient across the site is approximately 0.005. Using this gradient, the representative hydraulic conductivity and a porosity of 0.3, a horizontal groundwater velocity of .53 metres/year is calculated for

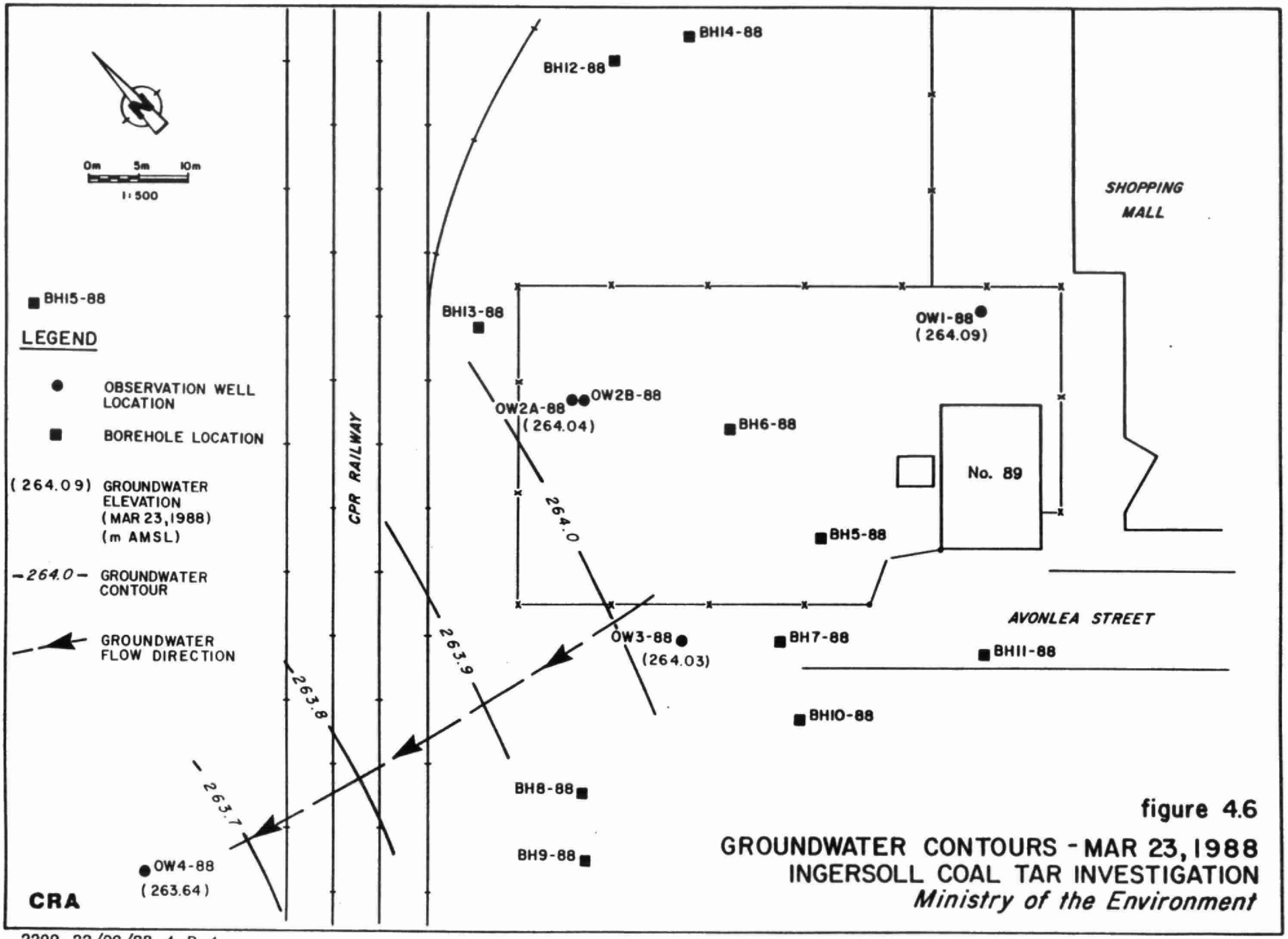

figure 4.6

GROUNDWATER CONTOURS - MAR 23, 1988
INGERSOLL COAL TAR INVESTIGATION
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the Site. The western boundary of the Site is approximately 100 meters (shortest distance) from the Thames River. Based on the above information, the travel time for groundwater in the sand and gravel unit from the downgradient Site boundary to the Thames River is in the order of 150 to 200 years.

4.3 EXTENT OF VISUAL CONTAMINATION

A dense, non-aqueous phase liquid (NAPL) was intersected in nine of the sixteen borings completed. Based on the waste characterization performed by Ocean Chem, the NAPL has been shown to consist predominantly of coal tar which contains PAHs (see Section 5.2). Therefore, for purposes of this report, the following definitions are used:

i) Non-Aqueous Phase Liquid (NAPL) - refers to that portion of the coal tar which is not dissolved in groundwater and can be visually identified as a separate and distinct material.

ii) Aqueous Phase Liquid (APL) - refers to that portion of the coal tar which is dissolved in groundwater and cannot be visually identified as a separate and distinct material.

Coal tar typically has a relative density of between 1.2 and 1.5 and a viscosity approaching 130 centipoise. Coal tar is approximately 30% more viscous than water. Results of the drilling programs indicate that coal

tar NAPL is present in the sand and gravel unit and appears to extend to the top of the bedrock. The presence of NAPL contamination in the bedrock, if any, could not be determined using auger drilling techniques. Coal tar NAPL, more dense than groundwater will migrate under the influence of gravity following the path of least resistance.

Coal tar NAPL saturated sands cover two-thirds of the Site and are known to extend off-site as far as BH9-88. Coal tar NAPL was not encountered northwest of the Site beyond the CPR tracks. Figure 4.7 illustrates the identified areal extent of coal tar NAPL saturated sands intersected in the borings. Table 4.2 summarizes the extent of coal tar NAPL observed in all boreholes completed.

Coal tar NAPL saturated sands were encountered in BH10-88, which is located immediately adjacent to the residence at No. 92 Avonlea St., at a depth of approximately ten metres (30 feet) below ground surface. The presence of coal tar NAPL saturated sands at this location is well below the basement of this residence, estimated to be 2.5 metres (eight feet) below ground surface.

Three areas of contamination are identified in Figure 4.7 although they are of a single source (see Section 5.2). In the areas of BH12-88, BH13-88 and BH14-88, NAPL was encountered in the fill material. The vertical extent of the NAPL was not determined as this was not within the scope of the extended drilling program. It is not possible to determine, with existing data, whether the NAPL encountered at these locations is isolated or

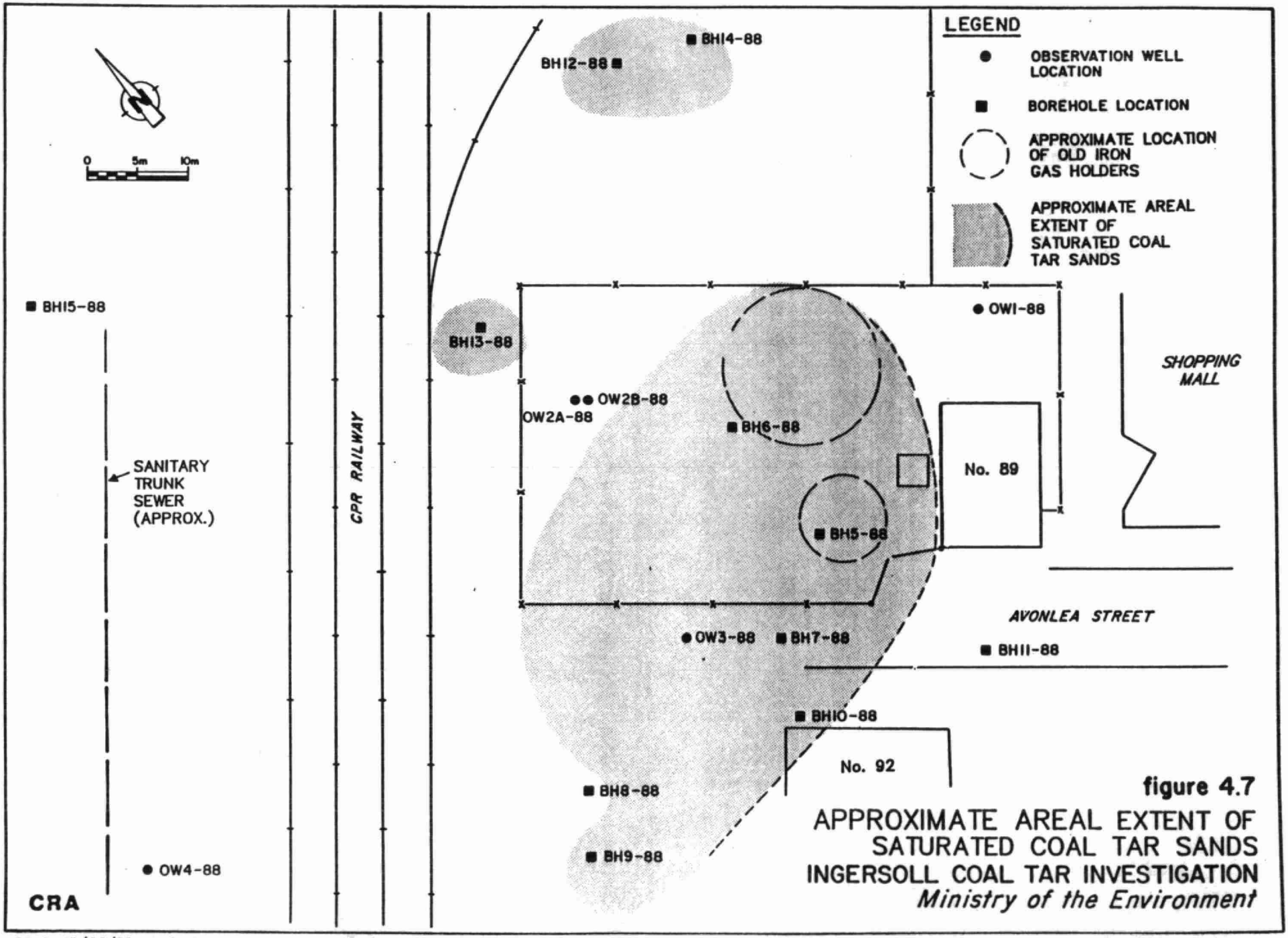

figure 4.7

APPROXIMATE AREAL EXTENT OF SATURATED COAL TAR SANDS
INGERSOLL COAL TAR INVESTIGATION
Ministry of the Environment

2299-13/06/88-4-D-0

TABLE 4.2

SUMMARY OF CONTAMINATION
OBSERVED IN BOREHOLES

Borehole Number	Ground Surface Elevation (m) *	Total Depth (m BGS)	Degree of Contamination	Stratigraphic Description (1) (Depths in m BGS)		Comments
Initial Drilling Program						
OW1-88	271.18	12.98	slight odour	0.0-1.25	SW-GW SAND&GRAVEL(Fill)	Hnu (BS) =2 ppm
				1.25-11.58	SP SAND	
			no visible contamination	11.58-12.95	GW GRAVEL	Hnu (BS) =1 ppm
				12.95-12.98	LIMESTONE (auger refusal)	
OW2A-88	269.88	10.97	no visible or odourous contamination	0.0-3.92	ML SILT (Fill)	Hnu (BS) =1 ppm
				3.92-4.82	SM SAND	
				4.82-5.69	OL ORGANIC SILT	
				5.69-10.05	SP SAND	Hnu (BS) =1 ppm
				10.05-10.97	GW GRAVEL	
				at 10.97	LIMESTONE (auger refusal)	
OW2B-88	270.34	4.82	no visible or odourous contamination	STATIGRAPHY AS PER OW2A-88		
						see note (2)
OW3-88	269.81	10.97		0.0-1.53	ML-GM SILT & GRAVEL (Fill)	Hnu (A)=3.5 ppm
			gross contamination (5.8m to EOH)	1.53-2.75	ML-SM SAND (Fill)	Hnu (A)=5.0 ppm
				2.75-10.67	SM-SP SAND	Hnu (BS)=1.5 ppm
				10.67-10.97	GW GRAVEL	Hnu (HS)=>1000 ppm
				at 10.97	LIMESTONE (auger refusal)	Hnu (BS)=2.0 ppm
						Hnu (BS)=1.5 ppm
						Hnu (A)=5.5 ppm
OW4-88	266.68	8.29	no visible or odourous contamination	0.0-1.16	ML SILT (Fill)	Hnu (BS)=1.0 ppm
				1.16-3.72	SM SAND	
				3.72-5.33	SW SAND	
				5.33-8.29	GP-GW GRAVEL	Hnu (BS)=1.0 ppm
				at 8.29	LIMESTONE (auger refusal)	

continued . . .

TABLE 4.2
SUMMARY OF CONTAMINATION
OBSERVED IN BOREHOLES

Borehole Number	Ground Surface Elevation (m) *	Total Depth (m BGS)	Degree of Contamination	Stratigraphic Description (1) (Depths in m BGS)		Comments
BH5-88	270.62	4.57		0.0-0.37	GW GRAVEL (Fill)	Hnu (BS)=1.5 ppm
				0.37-2.59	FILL (construction rubble)	Hnu (BS)=1.5 ppm
				2.59-3.87	VOID	Hnu (BS)=3.0 ppm
			raw product	3.87-4.57	COAL TAR	Hnu (BS)=20.0 ppm see note (3)
Extended Drilling Program						
BH6-88	270.62	10.67	odourless	0.0-3.05	SM-GW SAND & GRAVEL (Fill)	
			slight odour	3.05-6.10	SM SAND	
			gross contamination	6.10-10.67	SM SAND	
BH7-88	270.18	10.67		0.0-1.53	SM-GW SAND & GRAVEL (Fill)	
			gross contamination	1.53-4.58	SM SAND	
			(5.2m to EOH)	4.58-10.67	SM SAND	
BH8-88	267.58	9.02	no visible	0.0-9.02	SM SAND	
			or odourous	at 9.02	LIMESTONE (auger refusal)	
			contamination			
BH9-88	267.36	9.14	5cm of contamination at 7.3m	0.0-9.14	SM SAND	
BH10-88	270.08	10.67	gross contamination (9.9m to EOH)	0.0-10.67	SM SAND	
BH11-88	270.74	10.67	no visible	0.0-10.67	SM SAND	
			or odourous			
			contamination			
BH12-88	267.27	4.57	gross contamination 3.3m to EOH	0.0-4.57	SM-GW SAND& GRAVEL (Fill)	

continued . . .

TABLE 4.2

SUMMARY OF CONTAMINATION
OBSERVED IN BOREHOLES

Borehole Number	Ground Surface Elevation (m) *	Total Depth (m BGS)	Degree of Contamination		Stratigraphic Description (Depths in m BGS)	Comments
BH13-88	267.17	3.05	slight odour (grd-2.1m) gross contamination (2.1m-EOH)	0.0-3.05	SM-GW SAND& GRAVEL (Fill)	
BH14-88	267.2	3.05	slight odour (grd-2m) gross contamination. (2 m-EOH)	0.0-3.05	SM-GW SAND& GRAVEL (Fill)	
BH15-88	267.19	9.14	no visible or odourous contamination	0.0-7.92 7.92-9.14	SM SAND BEDROCK	

NOTES:

(1) Based on Unified Soil Classification System

(2) All Hnu readings for this well were taken between depths of 6.1m and 10.7 m bgs.
Hnu (A)- represents Hnu reading taken in the augers
Hnu (BS)- represents Hnu reading taken in the breathing space
Hnu (HS)- represents Hnu reading taken in the headspace

(3) At Hnu reading of 20 ppm, the drilling was shut down and level B Health and Safety was invoked.
At the south fenceline Hnu readings were 1.5,1.0, and 1.5 ppm and in the headspace the Hnu reading was >1000 ppm

continuous across the Site. It is of interest to note, however, that information provided to CRA by the Town of Ingersoll on June 6, 1988, indicated that during the course of the geotechnical investigation conducted for the plaza located southeast of the Site, Trow (1979) reported intersecting fill heavily contaminated by "oil" in BH5-79 (see Appendix F). The "oil" contamination is reported to continue into the underlying sand and extends down to the water table. The approximate location of the borehole (BH5-79) is midway between OW1-88 and BH14-88. If the "oil" contamination is in fact coal tar, then the contamination may extend further than indicated in Figure 4.7 and may in fact be continuous across the Site.

4.4 REVIEW OF SERVICE PLANS

Service plans for the area in the vicinity of the Site were requested, however, they were not available from the town Engineering Department. However, a 203-mm diameter sanitary sewer and a 102-mm diameter high pressure gas main are known to exist below Avonlea Street and extend no further than No. 89 Avonlea Street. A watermain is also assumed to exist along Avonlea Street. A storm sewer was not observed along Avonlea Street. A sanitary trunk sewer is also located between the CPR railway and OW4-88 (see Figure 4.7).

The depth to groundwater in the vicinity of the building at No. 89 Avonlea St. is approximately five metres and in the area of OW4-88 is approximately three metres. The minimum depth to coal tar NAPL on Site

(BH5-88) is approximately four metres. It is reasonable to assume that the services along Avonlea Street, would be installed, at a maximum depth, immediately below frost depth penetration (approximately 1.5 metres). Therefore, it is reasonable to conclude that all the underground services along Avonlea Street are constructed above the groundwater table and will not be impacted or have an impact on potential coal tar NAPL and/or APL.

5.0 ANALYTICAL RESULTS

As discussed in Sections 3.2 and 3.5, soil and groundwater samples were collected for chemical analyses. The analytical results for the soil and groundwater samples are presented and assessed in the following sub-sections.

5.1 DATA VALIDATION

The following details an analytical data assessment and validation of the results obtained by the four analytical laboratories involved for the analytical samples collected at the Ingersoll Site.

The evaluation of the analytical data was based on the information provided in the report package supplied by the contract laboratories involved, including: field duplicate data, lab blank data, field blank data, as well as recovery data from matrix and surrogate spikes. The analytical data was assessed for consistency, accuracy and precision based on the review of the recovery data as well as the comparability of the duplicate analyses.

Four laboratories were involved in the analyses of the Ingersoll samples: Novalab Ltd., Lachine, Que., was responsible for the organic analyses; Beak Analytical Services, Brampton performed the metals analyses; OceanChem Group, Dartmouth, N.S. provided the organic

characterization/classification; and Conestoga-Rovers & Associates analyzed the samples for the groundwater quality indicator parameters.

Novalab had a computer problem which caused a loss of the data associated with the first analyses of Ingersoll samples OW4-88 and OW3-88 (Duplicate). As a result, these two samples had to be analyzed a second time. In addition, two Ingersoll samples (OW4-88 and OW2A-88) had very low d8-naphthalene extraction recoveries and as a result, were quantified using the purgeable analysis data. However, the surrogate recoveries and field duplicate data shows that the methods used were in control and the analyses were reproducible.

Based on CRA's review of the data reported by Novalab for the organics and by Beak Analytical Services for the metals analyses, it is apparent that the data associated with the analyses of the samples are acceptable, accurate and complete, with the exceptions and specific qualifications noted above and in Section 5.3. Consequently, with these qualifications and recommendations duly noted, this data may be used for its original intended purpose.

5.2 WASTE CHARACTERIZATION

Three soil samples were selected and submitted to OceanChem for waste characterization. OceanChem's analytical report is presented in Appendix G.

One sample was collected from BH3-88 at a depth of approximately 7.6 metres; the second sample was collected from BH5-88 immediately below the void; and, the third sample was collected from BH12-88 at a depth of approximately 3.4 metres.

All samples were characterized by capillary gas chromatography, with flame ionization detection. Ocean Chem reported that a high degree of chromatographic pattern similarity was observed in all three samples. The majority of components in all three samples appear to be aromatic hydrocarbons (most likely both alkylated and non-alkylated polynuclear aromatic hydrocarbons (PAHs). A high degree of similarity was observed in all three samples, however, the sample collected from BH3-88 contained several early eluting compounds, not observed in the other two samples. Although the identity of these compounds has not been established by confirmatory techniques such as capillary gas chromatography/mass spectroscopy (GC/MS), the identity of the additional early eluting compounds appears to be consistent with the presence of PAHs.

It can be concluded, therefore, that all three samples contain a majority of PAHs and most likely originate from a common source.

Since the wastes contain similarly PAHs, it is confirmed that the waste present below the Site, is coal tar.

5.3 GROUNDWATER DATA AND ASSESSMENT

A complete set of groundwater samples were collected from the observation wells (except OW2B-88 which was dry) and were analyzed for the parameters summarized previously on Table 3.4.

The complete analytical reports are presented in Appendix H. The analytical data for general chemistry, trace metals and organics (volatiles and PAHs) are summarized in Tables 5.1, 5.2 and 5.3, respectively.

As illustrated on Figure 4.6, presented previously, observation well OW1-88 is upgradient of the old manufactured gas plant site. No visual evidence of NAPL was detected in this well (see Table 4.2). This well, therefore, serves to monitor the background groundwater quality, relative to the Site.

Observation well OW2A-88 is located in the northwestern corner of the Site, outside the identified limits of coal tar NAPL saturated sands (see Figures 4.4 and 4.7). This well is located downgradient to the northeastern portion of the Site, and serves to monitor downgradient APL concentrations, relative to the Site.

TABLE 5.1

GENERAL CHEMISTRY

Parameter	Concentration (mg/L) (1)						
	OW1-88	OW2A-88	OW3-88	OW3-88 (Dup.)	OW4-88	Bailer Rinse	Drinking Water Guidelines
pH	7.18	7.16	7.05	7.11	7.21	8.08	6.5-8.5
Alkalinity	370	378	437	424	372	2.1	-
Bicarb. Alk.	370	378	437	424	372	2.1	-
Calcium	188	188	192	214	123	<1.0	-
Calcium (Beak)	182	167	180	187	109	0.20	-
Chloride	177	492	152	149	18	<1.0	250 *
COD	226.0	74.0	52.0	55.0	80.0	61.0	-
NH3-N	0.05	0.08	0.25	0.11	0.88	<0.02	-
TKN	2.58	0.76	0.83	0.77	2.84	<0.02	0.15 *(2)
Phenols	0.014	<0.001	<0.001	<0.001	<0.001	0.003	0.002 *
Potassium (Beak)	19.4	15.8	17.1	17.6	9	<0.05	-
Sodium (Beak)	86	240	100	102	15.5	<0.5	-
Sulfate	119.0	93.0	117.0	151.0	13.0	<1.0	500 *
Thiocyanate	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	-
T O C (Beak)	1.5	1.50	1.5	1.5	3.5	3.0	5.0 *
Sulfite	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-
Hardness	648	632	680	652	432	<2.0	-

NOTES:

(1) All concentrations in mg/L except pH and Hardness.
All analyses conducted by CRA unless otherwise noted in parameter column.
* Maximum Desirable Concentrations (Aesthetics) - Ontario Drinking Water Objectives, Revised 1983
\- Drinking Water Guideline not available.
(2) TKN minus NH3-N

TABLE 5.2

TRACE METALS ANALYSIS OF GROUNDWATER

Parameter	Concentration (mg/L)							
	OW1-88	OW2A-88	OW3-88	OW3-88 (Dup.)	OW4-88	Bailer Rinse	Trip Blank	Drinking Water Guidelines
Aluminum	0.20	0.18	0.20	0.20	0.14	<0.02	<0.02	-
Barium	0.20	0.23	0.17	0.17	0.05	<0.01	<0.01	-
Beryllium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Cadmium	<0.0001	<0.0001	0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.005 (1)
Chromium	0.01	0.01	0.01	0.02	<0.01	<0.01	<0.01	-
Cobalt	0.02	0.02	0.02	0.02	0.01	<0.01	<0.01	-
Copper	0.055	0.065	0.020	0.020	0.030	<0.005	<0.005	1.0 (2)
Iron	<0.02	<0.02	0.02	0.02	<0.02	<0.02	<0.02	0.3 (2)
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	0.008	0.001	0.05 (1)
Magnesium	34	37	38	39	18.2	<0.05	<0.05	1.0 (1)
Magnesium (CRA)	43.7	39.9	48.6	28.7	30.1	<1.0	<1.0	-
Manganese	0.57	1.68	0.59	0.60	0.62	<0.01	<0.01	0.05 (2)
Molybdenum	0.07	0.09	0.08	0.07	0.03	<0.01	<0.01	-
Nickel	0.01	0.01	0.02	0.02	<0.01	<0.01	<0.01	-
Strontium	2.1	4.4	2.9	2.9	0.60	<0.01	<0.01	-
Vanadium	0.015	0.015	0.015	0.015	0.005	<0.005	<0.005	-
Zinc	0.08	0.04	0.11	0.10	0.03	<0.01	<0.01	5.0 (2)

NOTES:

(1) Maximum Acceptable Concentrations (Health) - Ontario Drinking Water Objectives, Revised 1983

(2) Maximum Desirable Concentrations (Aesthetics) - Ontario Drinking Water Objectives, Revised 1983

All analyses conducted by CRA unless otherwise noted in parameter column.

- Drinking Water Guidelines not available

All parameters for metals analysis field filtered (0.45 micron)

TABLE 5.3

VOLATILES AND PAH's

Parameter	Concentration (ug/L)										
	OW1-88	OW2A-88	OW3-88	OW3-88 (Dup.)	OW3-88 (Dup.)	OW4-88	Bailer Rinse	Trip Blank	Trip Blank (Dup.)	Lab Blank	Method Detection Limit
VOLATILES:											
Benzene	TR	2.3	-	TR	TR	27	TR	-	TR		2
Chlorobenzene	-	-	-	-	-	-	-	-	-		2
1,2-Dichlorobenzene	-	-	-	-	-	-	-	-	-		2
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-	-		2
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-		2
Ethylbenzene	-	-	-	-	-	7.7	-	-	-		2
A-Methylstyrene	-	-	-	2	2	-	-	-	-		2
Methylstyrene Isomers	-	-	2.4	-	-	2.7	-	-	-		2
Mesitylene	-	-	-	-	-	-	-	-	-		2
Toluene	TR	6.3	-	4.4	5	8.5	3.8	3.5	11		2
M+P Xylene	-	-	-	-	-	5.8	-	-	-		2
O-Xylene	-	-	-	-	-	18	-	-	-		2
Other Aromatic Compounds	-	-	6.8	6.9	7.2	49	-	-	-		2
Styrene	-	-	-	-	-	-	-	-	-		2
PAH's:											
Naphthalene	0.05	2 *	50	37	N/A	112*	0.1	TR	N/A	0.05	0.05
Benzo(a)Pyrene	-	-	-	-	N/A	-	-	-	N/A	-	0.05

NOTES:

All analyses conducted by Novalab.

Other Aromatic Compounds = Total concentration of three trimethylbenzene isomers using the response factor of mesitylene.

\- Result less than method detection limit.

TR Trace compound detected.

* Values calculated from the purgeables analysis data.

N/A - Not Analyzed

Bailer rinse was collected after OW1-88 was sampled

Observation well OW3-88 is located along the southwestern boundary, downgradient of the Site. As illustrated on Figure 4.3, this well is screened within coal tar NAPL saturated sands. This well, therefore, serves to monitor downgradient APL and NAPL concentrations, relative to the Site.

Observation well OW4-88 is located west of the Site, across the CPR railway, directly downgradient of the Site. This well is beyond the limits of visible coal tar NAPL saturated sands and serves to monitor downgradient groundwater concentrations, relative to the Site.

A review of the general chemistry data, summarized on Table 5.1, indicates that with the exception of chloride in OW2A-88 and OW4-88 and sulfate in OW4-88, all parameters exhibit similar concentrations in the background and downgradient wells. As discussed above, observation wells OW2A-88 and OW4-88 are located outside the limits of coal tar NAPL saturated sands, downgradient of the Site. Well OW3-88 is located and screened within identified limits of coal tar NAPL saturated soils. The levels of chloride and sulfate in OW3-88 are very similar to those detected in the background well. Therefore, the changes in concentrations of chloride in OW2A-88 (elevated) and OW4-88 (decreased) and of sulfate in OW4-88 (decreased) are expected to be the result of localized interferences in groundwater quality, not associated with coal tar contamination.

A review of the trace metals data, summarized on Table 5.2, indicates that all parameters exhibit similar concentrations in the background and downgradient observation wells.

A review of the data summarized on Table 5.3 indicates that trace levels of benzene and toluene were detected in the background well OW1-88. Trace levels of benzene were also detected in the bailer rinsate and trip blank, indicating the trace levels in OW1-88 are due to either field decontamination and/or laboratory contamination. Naphthalene was detected in OW1-88 at a concentration of 0.05 ug/L. Naphthalene was also detected in the bailer rinsate at 0.1 mg/L, the lab blank at 0.05 ug/L, and trace levels were detected in the trip blank. Therefore, the naphthalene detected in OW1-88 can be attributed to field decontamination and/or laboratory contamination. In summary, no real volatiles or PAHs were detected in the groundwater sample from OW1-88.

Benzene and toluene were the only volatiles detected in downgradient well OW2A-88. Benzene was detected at a concentration of 2.3 ug/L and toluene at a concentration of 6.3 ug/L. Toluene, however, was also detected in the trip blank at 11 ug/L and in the bailer rinsate at 3.8 ug/L. Therefore, the toluene detected in OW2A-88 can be attributed to laboratory contamination and/or field decontamination. Naphthalene was detected in OW2A-88 at a concentration of 2 ug/L and is considered a real value.

Benzene, styrenes and toluene were the only volatiles detected in downgradient well OW3-88. Similar to the toluene and benzene

detected in OW1-88, the toluene and benzene detected in OW3-88 are attributed to laboratory and/or field decontamination. Styrene (A-Methylstyrene,Methylstyrene Isomers) was detected at a maximum concentration of 2.4 ug/L. Naphthalene was detected in OW3-88 at a maximum concentration of 50 ug/L. BAP was not detected in OW3-88, even though it is screened within the coal tar NAPL saturated sands.

Benzene, ethylbenzene, styrene, toluene and xylenes were all detected at elevated levels in OW4-88 and, with the exception of toluene, all values are considered real. Naphthalene was detected in OW4-88 at a concentration of 112 ug/L. BAP was not detected in OW4-88.

Observation well OW4-88 is located approximately 45 metres downgradient of the Site. No visual and/or olfactory evidence was noted during the installation of this well.

As discussed previously, the groundwater flow in the sand and gravel unit discharge to the Thames River and is not used as a drinking water supply. The MOE has established 'Ambient Water Quality Advisory' levels which include the parameters detected at OW4-88. The "Ambient Water Quality Advisory' levels for benzene, ethylbenzene, total xylene, styrene and naphthalene are 250 ug/L, 70 ug/L, 100 ug/L, 15 ug/L and 62 ug/L, respectively (personal communication, November 18, 1988 MOE). Only the concentration of the naphthalene of 112 ug/L detected in groundwater at OW4-88, exceeds the 'Ambient Water Quality Advisory' level.

Groundwater contamination (APL) , resulting from dissolution of coal tar components, moves with the groundwater. However, because of the limited water solubility, preferential partitioning and adsorption of most coal tar components, the movement of APL contaminants may be substantially retarded in a groundwater environment. According to the "Water-Related Environmental Fate of 129 Priority Pollutants Volume II" (Callahan, et al 1979) prepared for the USEPA, benzene, ethylbenzene and specifically naphthalene will be adsorbed by organic material. The rate of APL flow, therefore, is assumed to be slower than that of groundwater.

5.4 SUMMARY OF RESULTS

Based on the information presented in the previous Sections, the following observations are made:

1) The Site is generally separated into three geologic units: fill; sands and gravels; and limestone. The fill varies in thickness from 1.16 to 4.57 metres. The sands and gravels vary in thickness from 7.05 to 11.7 metres. The total average thickness of the overburden is 10.2 metres.

2) The groundwater flow in the overburden discharges to the Thames River, and is not used as a drinking water supply.

3) The Town of Ingersoll gets its water supply from communal municipal bedrock supply wells. The nearest communal well (Well #6) is some 500 metres from the Site. The well is a low yield standby well that is only used in periods of high water demand. The recharge area for the standby well may extend to the limestone underlying the Site. The communal system consists of four wells, in addition to the standby well collectively producing up to approximately 1,390 gpm (105 l/s). The main producing wells are located a minimum of 1.5 km from the former coal gasification plant Site. The vertical gradient between the bedrock and the overburden sand and gravel unit has not been determined.

4) Coal tar NAPL (refers to that portion of coal tar which is not dissolved in groundwater and can be visually identified as a separate and distinct material) saturated sands cover two-thirds of the Site and are known to extend off Site 25 metres as far as BH9-88 (see Figure 4.7). The coal tar NAPL saturated sands, which are approximately nine metres thick at location BH5-88, are covered by approximately four metres of fill. BH5-88 represents the maximum thickness of coal tar NAPL saturated sands which thin out in all directions from this location. The coal tar NAPL saturated sands extend down to the top of bedrock. Coal tar NAPL saturated fill is present to the north (BH12-88 and BH14-88) and west (BH13-88) of Site. The full horizontal and vertical extent of contamination off Site was not determined.

5) Waste characterization of the coal tar NAPL from the Site indicates that the coal tar present on and off Site most likely originated from a common source.

6) Based on available data, coal tar NAPL has not affected the general chemistry and trace metals parameters in the groundwater on Site. Coal tar indicator parameters (i.e. benzene, and naphthalene) were detected in the groundwater on Site.

7) Based on available data, groundwater in the area of OW4-88, downgradient of the Site, has been affected by volatiles and naphthalene. The full extent of groundwater contamination cannot be determined based on available data.

8) Based on available data, air quality at the Site has not been affected by coal tar related parameters.

5.5 ENVIRONMENTAL SIGNIFICANCE

Based on current conditions, the coal tar NAPL saturated material is covered sufficiently to prevent exposure to the waste through existing on-Site activities. Existing data also indicates that the air quality above the Site has not been affected by the presence of coal tar NAPL.

The full horizontal and vertical extent of the coal tar NAPL off Site has not been determined, however, is anticipated to be restricted to the vicinity of the Site. The likelihood of coal tar NAPL from the Site reaching the Thames River is extremely low.

The groundwater in the overburden on Site has been impacted by coal tar APL. The groundwater in the overburden is not used as a drinking water supply, however, the bedrock underlying the Site may be within the recharge area of municipal supply Well #6. The vertical gradient between the bedrock and the overburden at the Site was not determined. The MOE collected a raw water sample from Well #6 on March 23, 1988. The analytical results indicate that the well has not been impacted by coal tar related parameters.(Personal communication, MOE).

The groundwater flow in the overburden discharges to the Thames River. The travel time for groundwater in the overburden from the downgradient Site boundary to the Thames River was calculated to be in the order of 150 to 200 years. It can be reasonably assumed that coal tar APL migration to the Thames River might occur, however, the concentrations of APL will decrease with distance from the Site. The decrease in APL concentrations can be attributed to groundwater dilution and volatilization for the volatile components (i.e. benzene and ethylbenzene) and groundwater dilution and biodegradation for the PAHs (i.e. naphthalene).

The MOE collected three surface water and sediment samples from the Thames River on June 20, 1988. One surface water and one

sediment sample, respectively, were collected from locations upstream, adjacent and downstream of the Site. The analytical results for the surface water samples indicate that the water has not been impacted by coal tar related parameters. The analytical results for the sediment samples are not available. (Personal communications, MOE).

Notwithstanding the above, insufficient data is available know how far the coal tar APL has migrated from the site.

6.0 RECOMMENDATIONS

It is recommended that the coal tar contamination (i.e. NAPL) found on and off Site be registered on the land title(s). Restrictions on future land uses should include, but not be limited to, no change in land use on Site that could affect the cover over the coal tar or coal tar contaminated materials or expose the coal tar or coal tar contaminated materials to the atmosphere for a prolonged period of time. Restrictions should also include no excavation into the waste that would result in exposure unless safe excavation practices and disposal of the waste is considered.

Notwithstanding the above, the following additional work is recommended to be completed in the vicinity of the Site:

1) The completion of additional boreholes to the north and northwest of the Site to better define the horizontal and vertical extent of coal tar NAPL saturated fill and the west and southwest of the Site to better define the horizontal and vertical extent of coal tar saturated sands.

2) The completion of limestone observation wells. At a minimum three wells should be installed to determine the groundwater flow path in the limestone. One well should be nested with OW3-88 to determine if coal tar APL and/or NAPL is present in the limestone, and to evaluate the vertical gradient between the overburden and the limestone. This work should include additional rounds of groundwater samples from the existing observation wells and the proposed observation wells.

3) Depending upon the results of the MOE's stream sediment samples, further monitoring of the Thames River may be warranted.

All of which is respectfully submitted,

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APPENDIX A

GROUND CONDUCTIVITY AND MAGNETOMETER SURVEY RESULTS

APPENDIX A

Ground Conductivity and Magnetometer Survey Results
Ingersoll Coal Tar

North	East	Parallel	Perp.	Average	Decibel	Mag	Comments
0	0	100		100.0	12.4	4400	scrap metal
0	-20	175		175.0	17.3	11500	scrap metal
0	-40	92		92.0	11.7	2200	scrap metal
0	-60	95		95.0	12.0	1300	
0	-80	200		200.0	18.4	900	
0	-100	60		60.0	8.0	5000	
0	-120	48		48.0	6.0	3000	
0	-140	42		42.0	4.9	3800	
0	-160	38		38.0	4.0	1500	
0	-180					4000	
-20	-20					800	steel, axles, etc.
-20	-40	14		14.0	-4.7	2800	
-20	-60	15		15.0	-4.1	3500	
-20	-80	15		15.0	-4.1	3100	
-20	-100	78		78.0	10.2	3400	
-20	-120	52		52.0	6.7	3650	
-20	-140	26		26.0	0.7	3000	
-20	-160	38		38.0	4.0	2600	
-20	-180	48		48.0	6.0	4000	
-20	-188					2000	
-20	-195	25		25.0	0.4	6000	
-40	-20	220		220.0	19.2		trees & steel
-40	-40	145	65	105.0	12.8		drums on surface
-40	-60	16	11	13.5	-5.0	2600	drums on surface
-40	-80	9	9	9.0	-8.5	3850	
-40	-100	35	40	37.5	3.9	5800	
-40	-120	28	9	18.5	-2.3	5000	
-40	-140	16	24	20.0	-1.6	3700	
-40	-160	40	66	53.0	6.9	3400	
-40	-180	66	92	79.0	10.3	3400	
-40	-185					3000	
-40	-195	36	56	46.0	5.7	5400	
-60	-20						building
-60	-40						building
-60	-60	15	6	10.5	-7.2	2500	
-60	-70					3800	
-60	-80	8	8	8.0	-9.5	4000	
-60	-90					4000	
-60	-100		1	1.0	-27.6	4800	
-60	-120	12	11	11.5	-6.4	4400	
-60	-140	12	12	12.0	-6.0	4800	
-60	-160	22	21	21.5	-1.0	4200	
-60	-180	90	170	130.0	14.7	3600	
-60	-185	36	33	34.5	3.2	4400	
-60	-195	36		36.0	3.5	2200	
-80	-20						building
-80	-40						building
-80	-60	10	15	12.5	-5.7	2800	
-80	-70	60		60.0	8.0	4000	

APPENDIX A

Ground Conductivity and Magnetometer Survey Results
Ingersoll Coal Tar

North	East	Parallel	Perp.	Average	Decibel	Mag	Comments
-80	-80	30	35	32.5	2.6	6000	
-80	-90					8100	
-80	-95	80		80.0	10.5		
-80	-100	20	40	30.0	1.9	4400	
-80	-110					5000	
-80	-120	50	50	50.0	6.4	3700	
-80	-130						trailer
-80	-140	30	30	30.0	1.9		trailer
-80	-150					3600	surface drums
-80	-160	24	24	24.0	0.0	3900	
-80	-170	48	60	54.0	7.0	3700	
-80	-180	55	180	117.5	13.8		fence line
-73	-95					8800	
-72	-95	80		80.0	10.5		
-70	-160	24	24	24.0	0.0		
-110	-20						road interference
-110	-40						road interference
-110	-60	24		24.0	0.0	3400	beside gas line
-110	-70					4000	
-110	-80	12	4	8.0	-9.5	3500	
-110	-90					3800	
-110	-100	14	2	8.0	-9.5	3500	
-110	-110					3600	
-110	-120	15	20	17.5	-2.7	3400	
-110	-127	45		45.0	5.5		
-110	-130					3400	
-110	-140	24		24.0	0.0	3600	
-110	-150					2600	
-110	-160	22	16	19.0	-2.0	3400	
-110	-170					2050	
-110	-180	12	14	13.0	-5.3	3900	
-110	-190	17	19	18.0	-2.5	4800	
-110	-200					5400	R.R. tracks
20	-60	15	12	13.5	-5.0	1200	
20	-70					3200	
20	-80	10	10	10.0	-7.6	3500	
20	-90					3400	
20	-100	10	9	9.5	-8.0	3400	
20	-110					3600	
20	-120	12	14	13.0	-5.3	4000	
20	-130					3800	
20	-140	20	20	20.0	-1.6	3900	
20	-150					3900	
20	-160	26	27	26.5	0.9	3600	
20	-170					3600	
20	-180	24	24	24.0	0.0	3900	
20	-188					5000	
20	-195	35	36	35.5	3.4	3800	
40	-120	25	32	28.5	1.5	4200	

APPENDIX A

Ground Conductivity and Magnetometer Survey Results
Ingersoll Coal Tar

North	East	Parallel	Perp.	Average	Decibel	Mag	Comments
40	-130					4000	
40	-140	29	31	30.0	1.9	3400	
40	-150					3700	
40	-160	12	13	12.5	-5.7	4000	
40	-170					4000	
40	-180	16	16	16.0	-3.5	3600	
40	-188					4400	
40	-195					2000	
60	-120	95	30	62.5	8.3	3800	
60	-130					4000	
60	-150	25	18	21.5	-1.0	6800	
60	-155					3400	
60	-160	16	15	15.5	-3.8	3400	
60	-170					3600	
60	-180	12	11	11.5	-6.4	3700	
70	-120					3400	
70	-130					3200	
70	-140					6200	
70	-150					6000	
70	-160					4100	
70	-170					3600	
70	-180					3800	
80	-120	102	88	95.0	12.0		
80	-140	27	30	28.5	1.5		
80	-160	14	12	13.0	-5.3		
80	-180	10	9	9.5	-8.0		
	BACKGROUND READINGS						
-20	-280			32			
-40	-280			28			
-60	-280			20			
-80	-280			30			
-110	-280			10			

NOTES: - North, East are grid coordinates
- Parallel, Perp are EM31 readings obtained with the instrument parallel or perpendicular (Perp) to the line of traverse
- Average is of parallel and perpendicular EM31 readings
- Decibel: normalized EM31 readings
- Mag are Gradiometric Magnetometer readings

APPENDIX B

STRATIGRAPHIC AND INSTRUMENTATION LOG

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: OW1-88
PROJECT NO.: 2299
DATE COMPLETED: 7/3/88
CLIENT: MOE
DRILLING METHOD: 168mm ID HSA
LOCATION: REFER TO PLAN
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE ELEVATION GROUND ELEVATION	271.999 271.18				
1	SW-GW SAND & GRAVEL (FILL): some silt, dense, frozen to 0.58m, well graded, fine to coarse, 1.9mm dia. crushed aggregate, brown, slightly moist, slight petroleum odour.	269.93	BENTONITE SEAL 250mm ø BOREHOLE	1SS		21
2	SP - SAND: trace silt, dense, layered, poorly graded, medium grained, light brown, moist			2SS		23
				3SS		17
3	- 7.6mm seam of coarse SP at 3.35m, moist, dense, uniform, light brown			4SS		18
		267.37				
4	SP - SAND: dense, fine uniform, layered, moist, light brown layer of ML (sandy silt) from 3.6 - 3.8m		SAND PACK	5SS		14
5			50 mm ø PVC PIPE	6SS		8
6	- medium grained, layered, compact, moist			7SS		12
7		264.09 ▽	BENTONITE SEAL	8SS		10
	- wet	▽				
8			SAND PACK WELL SCREEN	9SS		15
9				10SS		11
10			BENTONITE SEAL	11SS		15
11	- occasional silt or clay seam		SAND PACK			
		259.60				
12	GW - GRAVEL: some sand, little silt, dense, well graded, water bearing					
13	Auger refusal; cuttings on plug appear to be limestone, unable to penetrate further due to extreme hardness	258.23 258.20				
	END OF HOLE @ 12.98m BGS					

SCREEN DETAILS:
Screened Interval:
263.58 to 262.08 AMSL
Length - 1.5 m
Diameter - 50 mm
Slot # 10
Material - PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

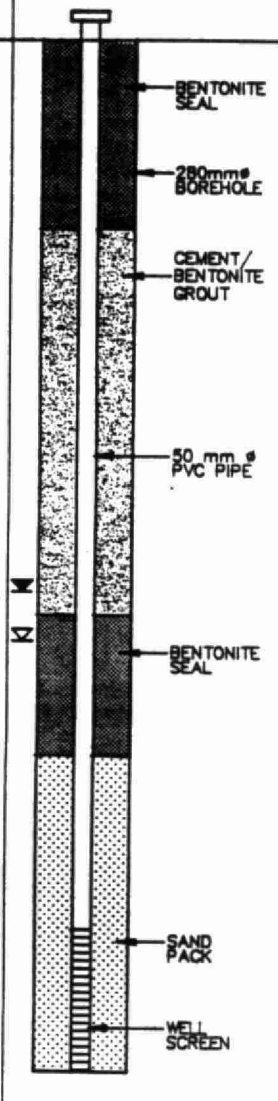
GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MOE
LOCATION: REFER TO PLAN

HOLE DESIGNATION: OW2A-88
DATE COMPLETED: 8/03/88
DRILLING METHOD: 168mm ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL
	REFERENCE ELEVATION GROUND ELEVATION	270.891 269.89
1	ML SILT (Fill): some sand, little clay, little gravel, roots, wood chips, bricks, steel, frozen 0.48m bgs, stiff, low plastic, dark brown, moist	
2		
	– moist, compact, reddish–brown, coal chips	267.60
3		
	– becomes OL at 3.6m, extremely dilatent, grey, wet at 3.5m, extremely soft,	266.29
4	SM – SAND: some silt, poorly graded, very loose, fine grained, layered, super saturated,	265.96
5	OL – ORGANIC SILT: some sand, compact, layered, low plastic, moist, black, shells, occasional pebbles to 0.6mm dia., slightly fibrous	265.07
		264.19
6	SP – SAND: little silt, compact, layered, medium grained, poorly graded, brown, very moist	264.04 263.79
	– wet	
7	– sand, little silt, loose, massive, medium grained, poorly graded, oxide brown, wet	263.03
8	–sand, medium–coarse, compact, poorly graded, wet	262.27
9	– sand, medium grained, wet	260.74
10	GW – GRAVEL: some sand, trace silt, dense, well graded, fine–coarse, with size increasing with depth, unable to sample, water bearing	259.83
11	Auger refusal on limestone bedrock @ 10.97m	258.91
12		
13		



SCREEN DETAILS:
Screened Interval:
258.91 to 260.44 AMSL
Length –1.5m
Diameter –50mm
Slot # 10
Material– PVC

SAMPLE NUMBER	STATE	'N' VALUE
1SS		15
2SS		13
3SS		8
4SS		6
5SS		0
6SS		3
7SS		4
8SS		4
9SS		6
10SS		9
11SS		8

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼ (23/03/88)

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: M.O.E.
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW2B-88
DATE COMPLETED: 8 Mar 1988
DRILLING METHOD: 168 mm ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT (Top Of Casing)	*271.007*				
	GROUND SURFACE	*270.34*				
1.0	Stratigraphy as per OW2A-88.		280mm ø BOREHOLE; BENTONITE SEAL; 50 mm ø PVC PIPE; SAND PACK; WELL SCREEN			
2.0						
3.0						
4.0						
5.0	END OF HOLE @ 4.82 m BGS.	*265.53*	SCREEN DETAILS: Screened Interval: 265.77 to 267.29 AMSL; Length -1.5m; Diameter -50mm; Slot # 10; Material- PVC			
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MOE
LOCATION: REFER TO PLAN

HOLE DESIGNATION: OW3–88
DATE COMPLETED: 9/03/88
DRILLING METHOD: 168mm ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE ELEVATION 270.802 GROUND ELEVATION 269.81					
1.0	GM – SILT & GRAVEL (Fill): some sand, frozen to 0.33m bgs, compact, well graded, bricks, plastic etc, moist, dark brown, oxide brown inclusions			1CS		
2.0	SM – SAND (FILL): some silt, ash & clay lumps, coal chuncks @ 2.4m, ash from 2.4–2.7m, very moist, loose, grey–brown	268.28		2CS		
3.0	SM – SAND: trace silt, trace fine gravel, compact, poorly graded, layered, medium grained, oxide brown, moist	267.06		3CS		
4.0						
5.0				4CS		
6.0	–wet @5.8m, strong PAH odour and discolouration – sand, with raw product from 6.3 to 9.0m bgs	264.03				
7.0				5CS		
8.0				6CS		
9.0	– strong PAH odour					
10.0				7CS		
11.0	GW GRAVEL: some sand, little silt, very dense, well graded, fine – coarse, saturated with PAH, strong odour	259.14		8CS		
	Auger refusal on limestone @ 10.97m BGS	258.83				
12.0						
13.0						

CEMENT/BENTONITE GROUT
280mm⌀ BOREHOLE
BENTONITE SEAL
50 mm⌀ B.I. PIPE
SAND PACK
WELL SCREEN

SCREEN DETAILS:
Screened Interval:
259.75 to 260.66 AMSL
Length – 0.91m
Diameter – 50mm
Slot # 10
Material – SS & B.I.P.

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

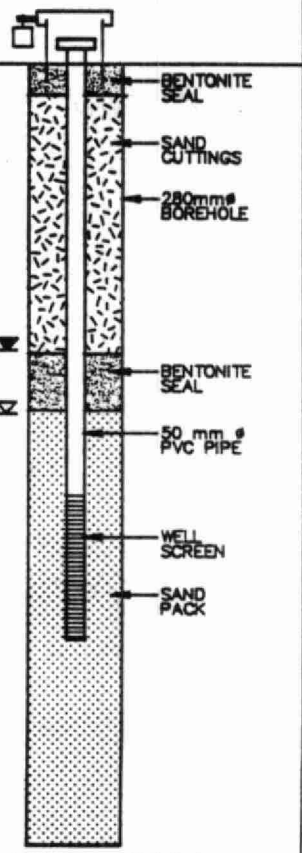
GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼ (23/03/88)

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MOE
LOCATION: REFER TO PLAN

HOLE DESIGNATION: OW4–88
DATE COMPLETED: 9/03/88
DRILLING METHOD: 168mm ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE ELEVATION GROUND ELEVATION	267.382 266.68				
1.0	ML SILT (FILL): some sand, trace clay, firm, low plastic, ashes, coal, steel, wood, very moist, brown/tan/black			1CS		
		265.52				
2.0	SM SAND: some silt, trace fine gravel, compact, layered, medium grained, oxide brown, occasional thin silt parting, odourless			2CS		
3.0		263.64	▼			
		262.96	▽	3CS		
4.0	SW SAND: some silt, some gravel, dense, well graded, layered, fine–coarse, wet, grey, odourless					
5.0						
		261.35		4CS		
6.0	GP GRAVEL: some sand, little silt, dense, poorly graded, layered, fine grain, water bearing well graded, layered, fine to coarse, water bearing, brown, odourless					
7.0				5CS		
8.0						
	Auger refusal on limestone bedrock @ 8.29m BGS	258.39				
9.0						
10.0						
11.0						
12.0						
13.0						



SCREEN DETAILS:
Screened Interval:
260.59 to 262.11 AMSL
Length –1.5m
Diameter –50mm
Slot # 10
Material– PVC

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼ (23/03/88)

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 1683
CLIENT: M.O.E.
LOCATION: AS PER PLAN

HOLE DESIGNATION: BH5–88
DATE COMPLETED: 10 Mar 1988
DRILLING METHOD: 168 mm ID HSA
CRA SUPERVISOR: S. CROSSMAN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	GROUND SURFACE *	270.62				
	GW GRAVEL: and sand, little silt, dense, well graded, fine to medium grained, bricks, coal, wood.	270.25	280mmø BOREHOLE; CEMENT/BENTONITE GROUT			
1.0	FILL (construction rubble): bricks, rock, steel, wood, sand, concrete, etc.					
2.0						
	VOID: augers turning freely.	268.03				
3.0	– concrete slab					
4.0	COAL TAR: in very loose sand matrix.	266.75				
	END OF HOLE @ 4.57 m BGS.	266.05				
5.0	NOTES: 1. Elevation estimated from BH6–88.					
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: BH6–88

PROJECT NO.: 2299
DATE COMPLETED: 28–MAR–88

CLIENT: MINISTRY OF THE ENVIRONMENT
DRILLING METHOD: 108mm SSA

LOCATION: REFER TO PLAN
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	270.617 270.62				
1.0	SM–GW SAND and GRAVEL (Fill): trace silt, loose, well graded, fine to medium grained, brown, moist, no odour.		BENTONITE HOLE PLUG	1AF		
2.0			165mms BOREHOLE	2AF		
3.0		267.57				
4.0	SM SAND: some gravel, trace silt, loose, very moist, fine to medium grained, poorly graded, brown, slight PAH odour at 3.7m.			3AF		
5.0	–brown/black, slight PAH odour			4AF		
6.0	–some gravel, little silt, dark brown, wet					
7.0			NATIVE BACKFILL	5AF		
8.0	–fine to medium grained, coal tar saturated to end of hole			6AF		
9.0						
10.0				7AF		
11.0	END OF HOLE @ 10.67 m BGS.	259.95				
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MINISTRY OF THE ENVIRONMENT
LOCATION: REFER TO PLAN

HOLE DESIGNATION: BH7-88
DATE COMPLETED: 28-MAR-88
DRILLING METHOD: 108mm SSA
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT	270.177				
	GROUND	270.18				
1.0	SM-GW SAND and GRAVEL (Fill): some silt, wood, fine to medium grained, compact, poorly graded, dark brown, moist.		BENTONITE HOLE PLUG			
2.0	SM SAND: trace gravel, some silt, compact, fine grained, poorly graded, brown, moist.	268.65	165mm BOREHOLE			
3.0						
4.0						
5.0	coal tar saturated to end of hole, wet					
6.0						
7.0			NATIVE BACKFILL			
8.0						
9.0						
10.0						
11.0	END OF HOLE @ 10.67 m BGS.	259.51				
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS (oval) WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MINISTRY OF THE ENVIRONMENT
LOCATION: REFER TO PLAN

HOLE DESIGNATION: BH8–88
DATE COMPLETED: 28–MAR–88
DRILLING METHOD: 108mm SSA
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	*267.577* *267.58*				
1.0	SM – SAND: some silt, compact, medium grained, poorly graded, brown, moist		BENTONITE HOLE PLUG	1AF		
2.0			185mm⌀ BOREHOLE	2AF		
3.0						
4.0				3AF		
	– wet, no coal tar present					
5.0				4AF		
6.0						
7.0			NATIVE BACKFILL	5AF		
8.0				6AF		
9.0	LIMESTONE	*258.55*				
	END OF HOLE @ 9.02 m BGS.					
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MINISTRY OF THE ENVIRONMENT
LOCATION: REFER TO PLAN

HOLE DESIGNATION: BH9-88
DATE COMPLETED: 28-MAR-88
DRILLING METHOD: 108mm SSA
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT	267.357				
	GROUND	267.36				
1.0	SM – SAND: some silt, compact, layered, fine to medium grained, poorly graded, brown, moist		BENTONITE HOLE PLUG	1AF		
2.0			185mmø BOREHOLE	2AF		
	– wet		▽			
3.0						
4.0				3AF		
5.0						
6.0				4AF		
7.0	– 5cm saturated thickness of coal tar		NATIVE BACKFILL	5AF		
8.0				6AF		
9.0						
	END OF HOLE @ 9.14 m BGS.	258.21				
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: BH10–88
PROJECT NO.: 2299
DATE COMPLETED: 29–MAR–88
CLIENT: MINISTRY OF THE ENVIRONMENT
DRILLING METHOD: 108mm SSA
LOCATION: REFER TO PLAN
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT	270.082				
	GROUND	270.08				
1.0	SM – SAND: some silt, compact, layered, fined to medium grained, poorly graded, brown, moist		BENTONITE HOLE PLUG	1AF		
2.0			165mmø BOREHOLE	2AF		
3.0						
4.0				3AF		
5.0						
6.0	– wet		▽	4AF		
7.0			NATIVE BACKFILL	5AF		
8.0						
9.0				6AF		
10.0	– coal tar saturated to end of hole			7AF		
11.0	END OF HOLE @ 10.67 m BGS.	259.41				
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MINISTRY OF THE ENVIRONMENT
LOCATION: REFER TO PLAN

HOLE DESIGNATION: BH11-88
DATE COMPLETED: 29-MAR-88
DRILLING METHOD: 108mm SSA
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	270.737 270.74				
1.0	SM SAND: some silt, trace gravel, compact, fine grained, poorly graded, brown, moist		BENTONITE HOLE PLUG	1AF		
2.0			165mmø BOREHOLE	2AF		
3.0						
4.0				3AF		
5.0	– light brown					
6.0				4AF		
7.0			NATIVE BACKFILL	5AF		
8.0				6AF		
9.0	– brown, moist					
10.0				7AF		
11.0	END OF HOLE @ 10.67 m BGS.	260.07				
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: BH12-88

PROJECT NO.: 2299
DATE COMPLETED: 29-MAR-88

CLIENT: MINISTRY OF THE ENVIRONMENT
DRILLING METHOD: 108mm SSA

LOCATION: REFER TO PLAN
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	*267.272* *267.27*				
1.0	SM & GM – SAND and GRAVEL (FILL): some silt, fine to medium grained, well graded, dark brown, moist, occ. root hairs		BENTONITE HOLE PLUG	1AF		
2.0			185mmø BOREHOLE	2AF		
3.0	– coal tar saturated to end of hole					
4.0			NATIVE BACKFILL	3AF		
5.0	END OF HOLE @ 4.57 m BGS.	*262.70*				
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
PROJECT NO.: 2299
CLIENT: MINISTRY OF THE ENVIRONMENT
LOCATION: REFER TO PLAN

HOLE DESIGNATION: BH13–88
DATE COMPLETED: 29–MAR–88
DRILLING METHOD: 108mm SSA
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	*267.167* *267.17*				
1.0	SM & GM – SAND and GRAVEL (Fill): some silt, fine to medium grained, well graded, compact, brown, moist, bricks, slight odour.		BENTONITE HOLE PLUG	1AF		
2.0	– coal tar saturated to end of hole		165mmø BOREHOLE	2AF		
3.0	END OF HOLE @ 3.05 m BGS.	*264.12*				
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: BH14–88

PROJECT NO.: 2299
DATE COMPLETED: 29–MAR–88

CLIENT: MINISTRY OF THE ENVIRONMENT
DRILLING METHOD: 108mm SSA

LOCATION: REFER TO PLAN
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT GROUND	*267.197* *267.20*				
1.0	SM & GM – SAND and GRAVEL: some silt, fine to medium grained, compact, dark brown, moist, bricks, slight odour.		BENTONITE HOLE PLUG	1AF		
2.0	– coal tar saturated to end of hole		185mms BOREHOLE	2AF		
3.0	END OF HOLE @ 3.05 m BGS.	*264.15*				
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: INGERSOLL COAL TAR
HOLE DESIGNATION: BH15-88

PROJECT NO.: 2299
DATE COMPLETED: 29-MAR-88

CLIENT: MINISTRY OF THE ENVIRONMENT
DRILLING METHOD: 108mm SSA

LOCATION: REFER TO PLAN
CRA SUPERVISOR: K. VANDERMEULEN

DEPTH m BG	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
	REFERENCE POINT	267.192				
	GROUND	267.19				
1.0	SM SAND(Fill): some gravel, trace silt, bricks, loose, wood, moist, brown.		BENTONITE HOLE PLUG	1AF		
2.0			185mmø BOREHOLE	2AF		
3.0						
4.0				3AF		
5.0						
6.0				4AF		
	SM SAND: trace gravel, some silt, loose, fine to medium grained, brown, wet.	261.10				
7.0			NATIVE BACKFILL	5AF		
8.0	BEDROCK auger refusal on limestone bedrock @ 7.99m bgs	259.27		6AF		
9.0						
10.0						
11.0						
12.0						
13.0						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

APPENDIX C

MANIFEST

Ontario — Ministry of the Environment / Ministère de l'Environnement

MANIFEST / MANIFESTE

"Regulation 309, R.R.O. 1980, Form 1." "Règlement 309, R.R.O. de 1980, formule 1."

CONFORMS TO TRANSPORTATION OF DANGEROUS GOODS REGULATIONS UNDER TDG ACT, CHAPTER 36, SC 1980

CONFORMEMENT AU REGLEMENT SUR LE TRANSPORT DES MARCHANDISES DANGEREUSES EN APPLICATION DE LA LOI SUR TMD CHAPITRE 36, SC 1980

P 93468-7

(Instructions on Reverse) / (Instructions au verso)

A Generator (Consignor) / Producteur (Expéditeur)

Generator Registration No. / Nº d'inscription du producteur (Provincial No.) / (Nº provincial): ON0199879

Company Name / Nom de la compagnie: Ontario Ministry of the Environment

Head Office Address / Adresse du siège social: 40 St. Clair Ave. W 5th Flr. — City / Ville: Toronto — Prov: Ont — Postal Code / Code postal: M4V 1P5

Shipping Site Address / Adresse du lieu d'expédition: 83 Avonlea St.

City / Ville: Ingersoll — Prov.: Ont. — Postal Code / Code postal:

Intended Receiver (Consignee) / Réceptionnaire (Destinataire) prévu: Tricil Ltd. — Receiver No. / Nº du réceptionnaire (Provincial No.) / (Nº provincial): A031809

Receiving Site Address / Adresse du lieu de réception: RR #1

City / Ville: Corunna — Prov.: Ont — Postal Code / Code postal: N0N 1G0

B Carrier / Transporteur

Certificate of Approval No. / Nº de certificat d'approbation (Provincial No.) / (Nº provincial): A-1858

Company Name / Nom de la compagnie: TRICIL

Address / Adresse: RR#1

City / Ville: Corunna — Prov: Ont — Postal Code / Code postal: N0N1G0

Registration / Enregistrement	License Plate No. / Nº de plaque d'immatriculation	Prov. / Prov.
Vehicle / Véhicule	PC5-546	ONT
Trailer # 1 / 1re remorque	972-054	ONT
Trailer # 2 / 2e remorque		

Point of entry / Point d'entrée: N/A — Point of exit / Point de sortie: N/A

Carrier Certification: I declare that the information contained in Section B is correct and complete.
Déclaration du transporteur: J'atteste que les renseignements inscrits à la partie B sont exacts et complets.

Name of Driver (print) / Nom du conducteur (lettres moulées): MARK A. LABRASSEUR — Tel. No. (Area Code) / Nº de tél. (ind. rég.): 519 862 1201

Signature: [signature] — Day / Jour Mon / Mois Yr / An: 13 07 88

Physical State (Solid, Liquid, Gas) / État physique (Solide, liquide, gaz)	Shipping Name of Waste / Appellation réglementaire des déchets transportés	Waste Identification No. / Nº d'identification des déchets — Provincial	TDGA / LTMD	Quantity Shipped / Quantité expédiée	Units L / kg / Unités	Classification	Packing Group / Groupe d'emballage	Concentration	Units (Specify) / Unités (préciser)	Packaging / Contenants — No. / Nbre de contenants	Codes int / ext
S	waste cont. w/ coal tar	2227	N/A	approx. 7650	KG	N/A	N/A	—		9	01

Special Handling/Emergency Instructions / *Instructions spéciales de manutention ou en cas d'urgence* — Attached / Annexées ☐ — Below / Ci-dessous ☐

Date Shipped / Date d'expédition — Day / Jour Mon / Mois Yr / An: 13 07 88 — Time / Heure: 8 45 ☒ AM ☐ PM

Scheduled Arrival Date / Date d'arrivée prévue — Day / Jour Mon / Mois Yr / An: 13 07 88

Generator (Consignor) Certification: I declare that the information contained in Section A is correct and complete.
Déclaration du producteur (expéditeur): J'atteste que les renseignements inscrits à la partie A sont exacts et complets.

Name of Authorized Person (print) / Nom de la personne autorisée (lettres moulées): Ed Roberts — Signature: [signature] — Tel. No. (Area Code) / Nº de tél. (ind. rég.): (519) 884 0510

C Receiver (Consignee) / Réceptionnaire (Destinataire)

Circulation No. (Quebec only) / Nº de circulation (réservé au Québec):

Other Manifest Number(s) / Autre(s) numéro(s) de manifeste(s):

Receiver No. / Nº du réceptionnaire (Provincial No.) / (Nº provincial):

Company Name / Nom de la compagnie:

Address / Adresse:

City / Ville — Prov. — Postal Code

Receiving Site Address / Adresse du lieu de réception

Date — Time / Heure — AM ☐ PM ☐

Quantity Received — Units — Identify Any Shipment Discrepancy/Problems. Attach addendum if necessary. — Handling Code / Code de manutention

If handling code "other" specify / Si le code de manutention est "autre", préciser

If waste to be transferred specify intended company name / Si les déchets doivent être transférés, préciser le nom du destinataire — Receiver No. (Provincial No.)

Address / Adresse — City / Ville — Prov.

Receiver (Consignee) Certification: I declare that the information contained in Section C is correct and complete. / Déclaration du réceptionnaire (destinataire): J'atteste que les renseignements inscrits à la partie C sont exacts et complets.

Name of Authorized Person (print) / Nom de la personne autorisée (lettres moulées)

Signature — Tel. No. (Area Code) / Nº de tél. (ind. rég.)

APPENDIX D

ALLOWABLE SANITARY SEWER DISCHARGE RATE

APPENDIX D

ALLOWABLE SANITARY SEWER DISCHARGE RATE

In order to satisfy MOE guidelines, the following equation calculates the allowable discharge rate of collected waters to the sanitary sewer:

$$Q_{DS} = (C_{EFF})(Q_{WWTP})/(S_{BAP})(1 - E_{WWTP})$$

where:

Q_{DS} = Allowable discharge rate of waters to sanitary sewer (litre/min.)

C_{EFF} = Maximum allowable incremental increase in WWTP effluent discharge (ug/L)

Q_{WWTP} = Average WWTP operating flow rate (litre/min.)

S_{BAP} = Solubility limit of BAP (ug/L)

E_{WWTP} = Assumed WWTP removal rate for BAP

For the Ingersoll site:

C_{EFF} = 0.01 ug/L (based on MOE guideline)

Q_{WWTP} = 1,250,000 gpd = 3,950 litre/min (based on information from MOE)

S_{BAP} = 3.8 ug/L

E_{WWTP} = 0.7 (based on MOE guideline)

Therefore:

Q_{DS} = (0.01)(3,950)/(3.8)(1 - 0.7) = 35 litre/min.

Based on the above, the discharge of collected waters to the sanitary sewers at a rate of 35 litres/min. would satisfy the MOE guidelines.

APPENDIX E

MUNICIPAL WELL INFORMATION

40P2W

UTM 1/7 Z 5/0/1/5/5 E
9 R 4/7/6/6/5/5/0 N

Elev. 9 R 0/9/2/5

Basin 23 13

Well #4

GROUND WATER BR'N
47 No.
JAN 14 1964
ONTARIO WATER RESOURCES COMMISSION

The Ontario Water Resources Commission Act

WATER WELL RECORD

County or District OXFORD Township, Village, Town or City N. OXFORD

Con. IV Lot 13 Date completed 26 (day) 7 (month) 6_ (year)

Owner INGERSOLL PUBLIC UTILITIES COMM (print in block letters) Address INGERSOLL ONT.

Casing and Screen Record		Pumping Test	
Inside diameter of casing	12"	Static level	VARIES FROM 31' to 42'-6"
Total length of casing	36'-8"	Test-pumping rate	480 I.G.
Type of screen	None —	Pumping level	77 ft.
Length of screen	—	Duration of test pumping	24 Hr.
Depth to top of screen	—	Water clear or cloudy at end of test	CLEAR
Diameter of finished hole	12" Rock hole to 441'-4" total depth.	Recommended pumping rate	500 I.G.
		with pump setting of	150 feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
TOPSOIL				
DRY COARSE SAND	0	1		
CLAY & GRAVEL -	1	19		
BROKEN LIMESTONE -	19	24		
BROWN LIMESTONE -	24	33		
GRAY LIMESTONE -	33	38		
BROWN LIMESTONE -	38	124		
GRAY LIMESTONE -	124	164	133'	FRESH S[illegible]
	164	441'-4"	295'.	ODOR SUL[illegible]

For what purpose(s) is the water to be used? MUNICIPAL W.S.

Is well on upland, in valley, or on hillside? VALLEY.

Drilling or Boring Firm

Address INTERNATIONAL WATER SUPPLY LTD
BOX 2460
12 MAITLAND ST. LONDON ONTARIO

Licence Number

Name of Driller or Borer J.E. McGEACHY.

Address 53 ST GEORGE ST.
LONDON ONT

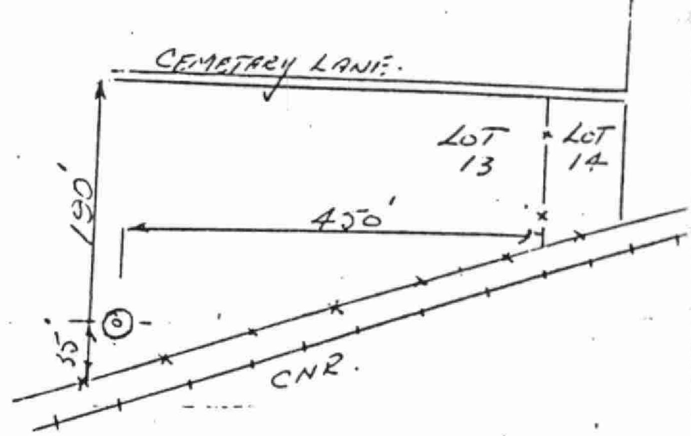
Date Jan 2/64 D.W. Harvey
(Signature of Licensed Drilling or Boring Contractor)

Form 7 15M-60-4138

OWRC COPY

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



1 7 - 5 1 0 8 0 0

4 R 4 7 6 4 6 8 0 1

6 R 0 9 2 0

2 3 1

4702999

The Ontario Water Resources Commission Act

WATER WELL RECORD

County or District Oxford Township, Village, Town or City Ingersoll

Lot Centennial Park Date completed 12 (day) 8 (month) 1970 (year)

Owner P.U.C. (print in block letters) Address Ingersoll

Casing and Screen Record

Inside diameter of casing 12"

Total length of casing 91'

Type of screen —

Length of screen —

Depth to top of screen —

Diameter of finished hole 12"

API

Pumping Test

Static level 53.22 FT Time & Date

Test-pumping rate 500 IGM G.P.M.

Pumping level 115.02 FT

Duration of test pumping 24 hrs

Water clear or cloudy at end of test CLEAR

Recommended pumping rate 320 G.P.M.

with pump setting of 150 feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Water Record: Depth(s) at which water(s) found	Water Record: Kind of water (fresh, salty, sulphur)
Fill	0'	5'		
Clay & gravel	5'	9'		
Gravel, boulders & clay	9'	15'		
Clay & gravel	15'	42'		
Hard gravel & clay	42'	50'		
Clay & gravel	50'	75'	155 FT	SULPHUR
Hard clay & gravel	75'	84		
Limestone	84'	357'		"

For what purpose(s) is the water to be used? Municipal Water Supply

Is well on upland, in valley, or on hillside? VALLEY

Drilling or Boring Firm International Water Supply Ltd.

Address Box 2483 London Ont.

Licence Number 2801

Name of Driller or Borer Don T. Bayerstein

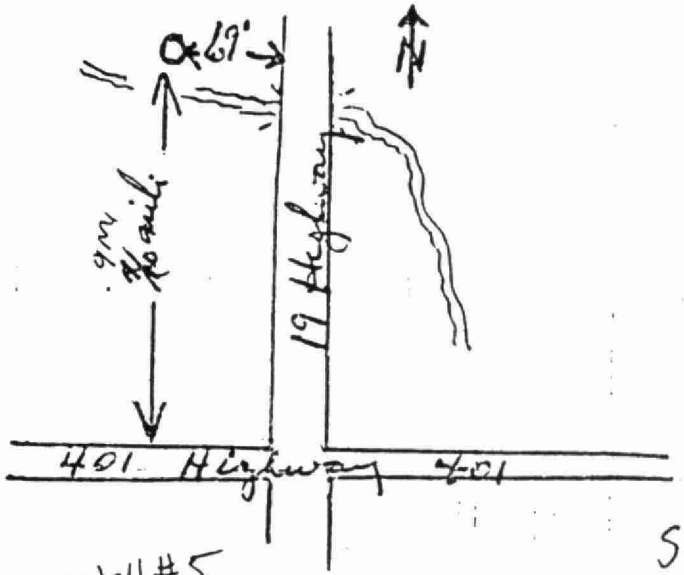
Address 2189 Dundas St. London Ont

Date June 16/70

Donald T. Hodgson
(Signature of Licensed Drilling or Boring Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Well #5

Form 7 15M-60-4138

WRC COPY

5-9

The Ontario Water Resources Commission Act

WATER WELL RECORD

40 F/20

Water management in Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 4703433 | MUNICIP. 47601 | CON.

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
OXFORD	INGERSOLL		

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
P.U.C.	INGERSOLL ONT	DAY 01 MO 05 YR 72

21 | ZONE 17 | EASTING 509300 | NORTHING 4764340 | RC 4 | ELEVATION 0930 | RC 5 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH – FEET FROM	TO
BROWN	GRAVEL	SILT - BOULDERS	PACKED	0	34
BROWN	CLAY	GRAVEL	PACKED	34	91
BROWN	LIMST.		SOFT	91	149
BROWN	LIMST.		HARD	149	364
NO DRILLING CHIP RETURNS			HARD	364	383
GREY	LIMST.		HARD	383	400
BROWN	LIMST		HARD	400	434
GREY	LIMST		HARD.	434	450

APL

31 | 0034... | 0091... | 0364... | 0400... | 0434... | 0450...

32

41 WATER RECORD

WATER FOUND AT – FEET	KIND OF WATER
0362 / 367 372	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☒ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH – FEET FROM	TO
12	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.375	+1	0094
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		94	0450
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN: SIZE(S) OF OPENING (SLOT NO.) | DIAMETER | LENGTH | MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN

61 PLUGGING & SEALING RECORD

DEPTH SET AT – FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
0	31	CEMENT GROUT

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER | PUMPING RATE 1300 GPM | DURATION OF PUMPING 11 HOURS 00 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
088 FEET	167 FEET	152	154	153	156

WATER LEVELS DURING: ☒ PUMPING ☐ RECOVERY

IF FLOWING, GIVE RATE: GPM | PUMP INTAKE SET AT 200 FEET | WATER AT END OF TEST: ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP | RECOMMENDED PUMP SETTING 200 FEET | RECOMMENDED PUMPING RATE 0350 GPM

003.8 GPM/FT. SPECIFIC CAPACITY

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

FRANCES ST. | WONHAM ST. | N. | 216' | 110' | 270'

DRILLERS REMARKS:

FINAL STATUS OF WELL: 1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 06: 1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☒ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING: 1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: INT. WATER SUPPLY | LICENCE NUMBER 2801

ADDRESS: BARRIE

NAME OF DRILLER OR BORER: R.E. Stech | LICENCE NUMBER 7808

SIGNATURE OF CONTRACTOR: [signature] | SUBMISSION DATE DAY 19 MO 5 YR 72

OFFICE USE ONLY

DATA SOURCE 1 | CONTRACTOR 2801 | DATE RECEIVED 270672

DATE OF INSPECTION 14.11.73 | INSPECTOR F/P

REMARKS: APL S.C

OWRC COPY

well #6

The Ontario Water Resources Commission Act

WATER WELL RECORD

40 P/24

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 4703433 | 14760

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.
OXFORD	INGERSOLL	

Owner (Surname First)	Address	Date Completed
P.V.C.	INGERSOLL ONT	Day 01 Mo 05 Yr 7.

21 | 17 509300 4764340 4 0930 5 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth – Feet From	To
BROWN	GRAVEL	SILT - BOULDERS	PACKED	0	34
BROWN	CLAY	GRAVEL	PACKED	34	91
BROWN	LIMST.		SOFT	91	149
BROWN	LIMST.		HARD	149	364
NO DRILLING CHIP RETURNS			HARD	364	383
GREY	LIMST.		HARD	383	400
BRN	LIMST		HARD	400	434
GREY	LIMST		HARD	434	450
		MW No 6			

APL

31 | 0034 | 0091 | 0364 | 0400 | 0434 | 0450

32 |

41 WATER RECORD

Water Found at – Feet	Kind of Water
0364	1 ☐ Fresh 3 ☒ Sulphur 2 ☐ Salty 4 ☐ Mineral
	1 ☐ Fresh 3 ☐ Sulphur 2 ☐ Salty 4 ☐ Mineral
	1 ☐ Fresh 3 ☐ Sulphur 2 ☐ Salty 4 ☐ Mineral
	1 ☐ Fresh 3 ☐ Sulphur 2 ☐ Salty 4 ☐ Mineral
	1 ☐ Fresh 3 ☐ Sulphur 2 ☐ Salty 4 ☐ Mineral

51 CASING & OPEN HOLE RECORD

Inside Diam Inches	Material	Wall Thickness Inches	Depth – Feet From	To
12	1 ☒ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open Hole	.375	+1	0094
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☒ Open Hole		94	0450
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open Hole			

SCREEN: Size(s) of Opening (Slot No.) | Diameter | Length | Material and Type | Depth to Top of Screen

61 PLUGGING & SEALING RECORD

Depth Set at – Feet From	To	Material and Type (Cement Grout, Lead Packer, etc.)
0	31	CEMENT GROUT

71 PUMPING TEST

Pumping Test Method: 1 ☒ Pump 2 ☐ Bailer
Pumping Rate: 0300 GPM
Duration of Pumping: 11 Hours 00 Mins

Static Level: 088 feet
Water Level End of Pumping: 167
Water Levels During: 1 ☒ Pumping 2 ☐ Recovery
15 minutes: 152 | 30 minutes: 154 | 45 minutes: 155 | 60 minutes: 156

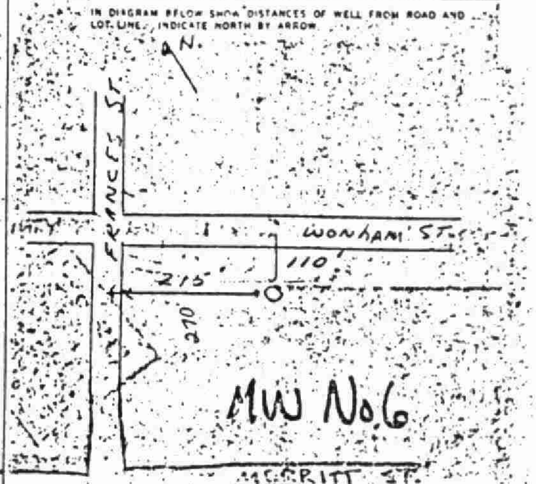
If Flowing Give Rate: GPM
Pump Intake Set at: 200 feet
Water at End of Test: 1 ☒ Clear 2 ☐ Cloudy

Recommended Pump Type: ☐ Shallow ☒ Deep
Recommended Pump Setting: 200 feet
Recommended Pumping Rate: 0350 GPM

003.8 GPM/FT. Specific Capacity

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☒ Water Supply
2 ☐ Observation Well
3 ☐ Test Hole
4 ☐ Recharge Well
5 ☐ Abandoned, Insufficient Supply
6 ☐ Abandoned, Poor Quality
7 ☐ Unfinished

WATER USE 06

1 ☐ Domestic
2 ☐ Stock
3 ☐ Irrigation
4 ☐ Industrial
☐ Other
5 ☐ Commercial
6 ☒ Municipal
7 ☐ Public Supply
8 ☐ Cooling or Air Conditioning
9 ☐ Not Used

METHOD OF DRILLING

1 ☒ Cable Tool
2 ☐ Rotary (Conventional)
3 ☐ Rotary (Reverse)
4 ☐ Rotary (Air)
5 ☐ Air Percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving

CONTRACTOR

Name of Well Contractor: INT. WATER SUPPLY — Licence Number: 2801
Address: BARRIE
Name of Driller or Borer: E.F. STROH — Licence Number: 7808
Signature of Contractor: [signature]
Submission Date: Day 18 Mo 5 Yr 77

OFFICE USE ONLY

Data Source: 1 | Contractor: 2801 | Date Received: 270672
Date of Inspection: 14.11.77 | Inspector: F/P
Remarks:

APL

OWRC COPY

REPORT

CONSTRUCTION AND TESTING

WELL NO. 8

INGERSOLL, ONTARIO

BACKGROUND

No. 4 Well was constructed in 1963. In recent years water quality monitoring has shown increasing nitrogen levels. In the opinion of the Ontario Ministry of the Environment, levels rose to values considered to be unacceptable for municipal water supply. Operation of Well No. 4 was stopped early in 1979. Source of the contamination was considered by the Ontario Ministry of the Environment to be associated with fertilizer blending southerly from No. 4 Well. Well No. 8 was authorized as a replacement for No. 4 Well at a distance of approximately 2,000 ft. northwesterly to attempt to develop a source free of the noted contamination.

ENCLOSURES

1. Well Diagram - showing construction of Well No. 8

2. Section Drawing - A-79409

3. Well Performance - Drawing B-79353

   This is a plot of the 3 step Step-Test performed on October 3, 1979 at the rates of 175, 350 and 525 IGM.

4. Aquifer Test Performance Curves

   (a) Drawdown vs Time

   (i) Drawing A-79399 - This is a semi log plot of drawdown vs time pumping Well No. 8 from 0800 hrs. October 4 to 0800 hrs. October 5 at the rate of 500 IGM. Recovery to 1600 hrs. October 5 is also shown.

   (ii) Drawing A-79400 - This is a semi log plot of drawdown vs time at Well No. 4 and nearby domestic well (Dorland) during the pumping and recovery of Well No. 8 noted above. These two wells were used as observation wells.

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

PRINT ONLY IN SPACES PROVIDED
CHECK ☒ CORRECT BOX WHERE APPLICABLE

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.	Lot
Oxford	North Oxford	III	12

Owner's Surname First	Address	Date Completed
Ingersol P.U.C.	Ingersoll Ontario	Day 12 Mo 10 Yr 7[illegible]

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth - Feet From	To
	topsoil			0	1
brown	clay	gravel & bldrs		1	6
	Sand & gravel			6	11
brown	clay	gravel & bldrs		11	14
	till	stoney silt		14	31
	boulders	stone grey clay		31	32
grey	clay	some gravel	silty	[illegible]	55
grey	boulders	gray clay	silty	55	[illegible]
Grey	clay	stoney		[illegible]	74
	till	stoney silt		74	[illegible]
	Limestone	shale		[illegible]	[illegible]
	Shale			[illegible]	[illegible]
	Limestone	shale str		103	112
	Shale	Limestone str		112	114
[illegible] brown	Limestone		hard	114	121
[illegible]	Limestone		hard	121	[illegible]
Grey	limestone			[illegible]	[illegible]
brown	limestone		hard	[illegible]	[illegible]
brown	limestone			180	[illegible]
brown	limestone		white str	[illegible]	[illegible]
brown	limestone		hard str of gray & white	[illegible]	[illegible]
grey	limestone		hard	[illegible]	[illegible]
brown	limestone		hard & gray white str	[illegible]	[illegible]
grey	limestone			[illegible]	411

WATER RECORD

Water found at - feet	Kind of water
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - Feet From	To
20"	✓ Steel ☐ Galvanized ☐ Concrete ☐ Open hole	.375	0	19
14"	✓ Steel ☐ Galvanized ☐ Concrete ☐ Open hole	.375	+1.5'	126'
12"	☐ Steel ☐ Galvanized ☐ Concrete ✓ Open hole		126'	411'

SCREEN

Slot No.	Diameter	Length
Material and type	Depth to top of screen	

PLUGGING & SEALING RECORD

Depth set at - feet From	To	Material and type (cement grout, lead packer, etc.)
126	7	Cement grout

PUMPING TEST

Pumping test method	✓ Pump ☐ Bailer
Pumping rate	500 GPM
Duration of pumping	24 hours — mins
Static level	B.G.L. 134.50 feet
Water level end of pumping	151.66 feet
Water levels during	✓ Pumping ☐ Recovery
15 minutes	148.09
30 minutes	148.43
45 minutes	
60 minutes	149.77
If flowing give rate	GPM
Pump intake set at	feet
Water at end of test	✓ Clear ☐ Cloudy
Recommended pump type	☐ Shallow ✓ Deep
Recommended pump setting	120 feet
Recommended pumping rate	500 GPM

FINAL STATUS OF WELL

✓ Water supply ☐ Abandoned, insufficient supply
☐ Observation well ☐ Abandoned, poor quality
☐ Test hole ☐ Unfinished
☐ Recharge well

WATER USE

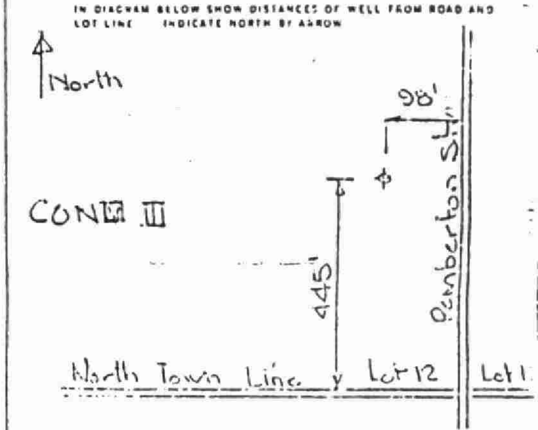
☐ Domestic ☐ Commercial
☐ Stock ✓ Municipal
☐ Irrigation ✓ Public supply
☐ Industrial ☐ Cooling or air conditioning
☐ Other ☐ Not used

METHOD OF DRILLING

✓ Cable tool ☐ Boring
✓ Rotary (conventional) ☐ Diamond
☐ Rotary (reverse) ☐ Jetting
☐ Rotary (air) ☐ Driving
✓ Air percussion

LOCATION OF WELL # 8

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



Driller's remarks

Contractor	
Name of well contractor	International Water Supply
Licence number	2801
Address	P.O. Box 310 Barrie Ontario
Name of driller or borer	A. Grimster
Licence number	

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Ontario

The Ontario Water Resources Act 408/2d

WATER WELL RECORD

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2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

4704665 4700B Con 01

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.	Lot
OXFORD	Ingersoll	I	013 -21

Owner (Surname First)	Address	Date Completed
Public Utilities Commission	143 Bell St. Ingersoll Ont	Day 26 Mo Sept Yr 77

17 508140 4763600 4 0910 4 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth - Feet From	To
	CLAY	BOULDERS		0	15
	"	GRAVEL, BOULDERS		15	22
GREY	"			22	37
	SAND	GRAVEL, BOULDERS CLAY		37	42
	CLAY	" "		42	63
	SAND	GRAVEL		63	67
BROWN	LIMESTONE	shale streaks to 70'/Br stks 221 to 227/GREY STKS 227-240	Crumbly to 134'	67	240
GREY	"			240	245
BROWN	"	white & black streaks		245	273
GREY	"	brown stks to 315 white stks 315-322	hard	273	322
GREY & BROWN	"	white streaks		322	344
GREY	"	" "		344	373
BROWN	"		hard	373	403

WATER RECORD

Water Found at - Feet	Kind of Water
63-67	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
67-403	☐ Fresh ☒ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral

CASING & OPEN HOLE RECORD

Inside Diam. Inches	Material	Wall Thickness Inches	Depth - Feet From	To
13 1/4"	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open Hole	.375	+2.5	138
12 1/4	☐ Steel ☐ Galvanized ☐ Concrete ☒ Open Hole		138	315
10	☐ Steel ☐ Galvanized ☐ Concrete ☒ Open Hole		315	403

SCREEN

Size(s) of Opening (Slot No.)	Diameter	Length
—	— inches	— feet
Material and Type	Depth to Top of Screen	feet

PLUGGING & SEALING RECORD

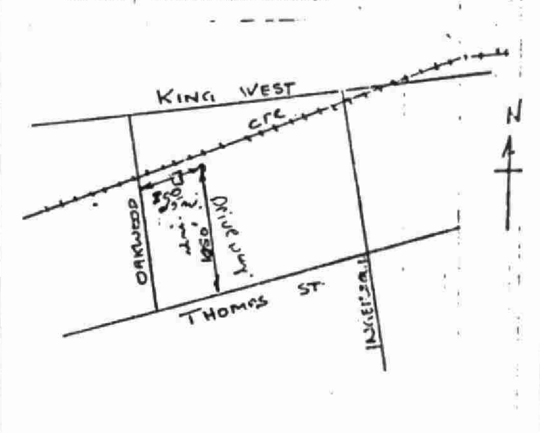
Depth Set At - Feet From	To	Material and Type (Cement Grout, Lead Packer, etc.)
0	138	GROUT BETWEEN 14" CASING & 12"Φ OPEN HOLE

PUMPING TEST

Pumping Test Method: ☒ Pump ☐ Bailer	Pumping Rate: 700 GPM	Duration of Pumping: 26 Hours 00 Mins	
Static Level: 43.28	Water Level End of Pumping: 61.57 feet	Water Levels During ☐ Pumping ☐ Recovery	
15 Minutes: 50.35 feet	30 Minutes: 51.38 feet	45 Minutes: —	60 Minutes: 52.30 feet
If Flowing, Give Rate: — GPM	Pump Intake Set At: — feet	Water at End of Test: ☒ Clear ☐ Cloudy	
Recommended Pump Type: ☐ Shallow ☒ Deep	Recommended Pump Setting: 100 feet	Recommended Pumping Rate: 700 GPM	

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW



DRILLERS REMARKS

FINAL STATUS OF WELL: ☒ Water Supply ☐ Observation Well ☐ Test Hole ☐ Recharge Well ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Quality ☐ Unfinished

WATER USE: ☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Other ☐ Commercial ☒ Municipal ☐ Public Supply ☐ Cooling or Air Conditioning ☐ Not Used

METHOD OF DRILLING: ☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☒ Rotary (Air) ☐ Air Percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving

Name of Well Contractor: INTERNATIONAL WATER SUPPLY LTD	Licence Number: 2801
Address: BOX 310 BARRIE	
Name of Driller or Borer: A. GRIMSTER	Licence Number:
Signature of Contractor: [signature]	Submission Date: Day 20 Mo OCT Yr 77

OFFICE USE ONLY: 161177 — 27/09/78 — A.P.L — DNW — MW

CONTRACTOR'S COPY

FORM 7 0506 4-77

Well #7

INTERNATIONAL WATER SUPPLY, LTD.

R E P O R T

INGERSOLL PUBLIC UTILITIES COMMISSION

CONSTRUCTION AND TESTING

WELL NO. 7 - 1977

REFERENCE

Proposal - July 5, 1977

ENCLOSURES

1. Well Diagram

   This shows the construction of the well.

2. Aquifer Performance Test Curves

   (a) Drawdown vs Time - Drawing A-77465

   This is a semi-log plot of drawdown vs time pumping Well No. 7 at 700 IGM from 1000 hours September 20 to 1200 hours September 21, with recovery to 2200 hours September 21.

   (b) Hydrographs

   (i) Merritt Street Well No. 2 - Drawing A-77466

   The Merritt Street Wells were off prior to and during the test, as noted. Air line measurements were used to monitor levels. The theoretical transmissivity required to cause these slight changes as a result of pumping No. 7 are too high to reasonably conclude the water level changes were the result of pumping at Well No. 7. We conclude that measured interference at Merritt Street is unlikely.

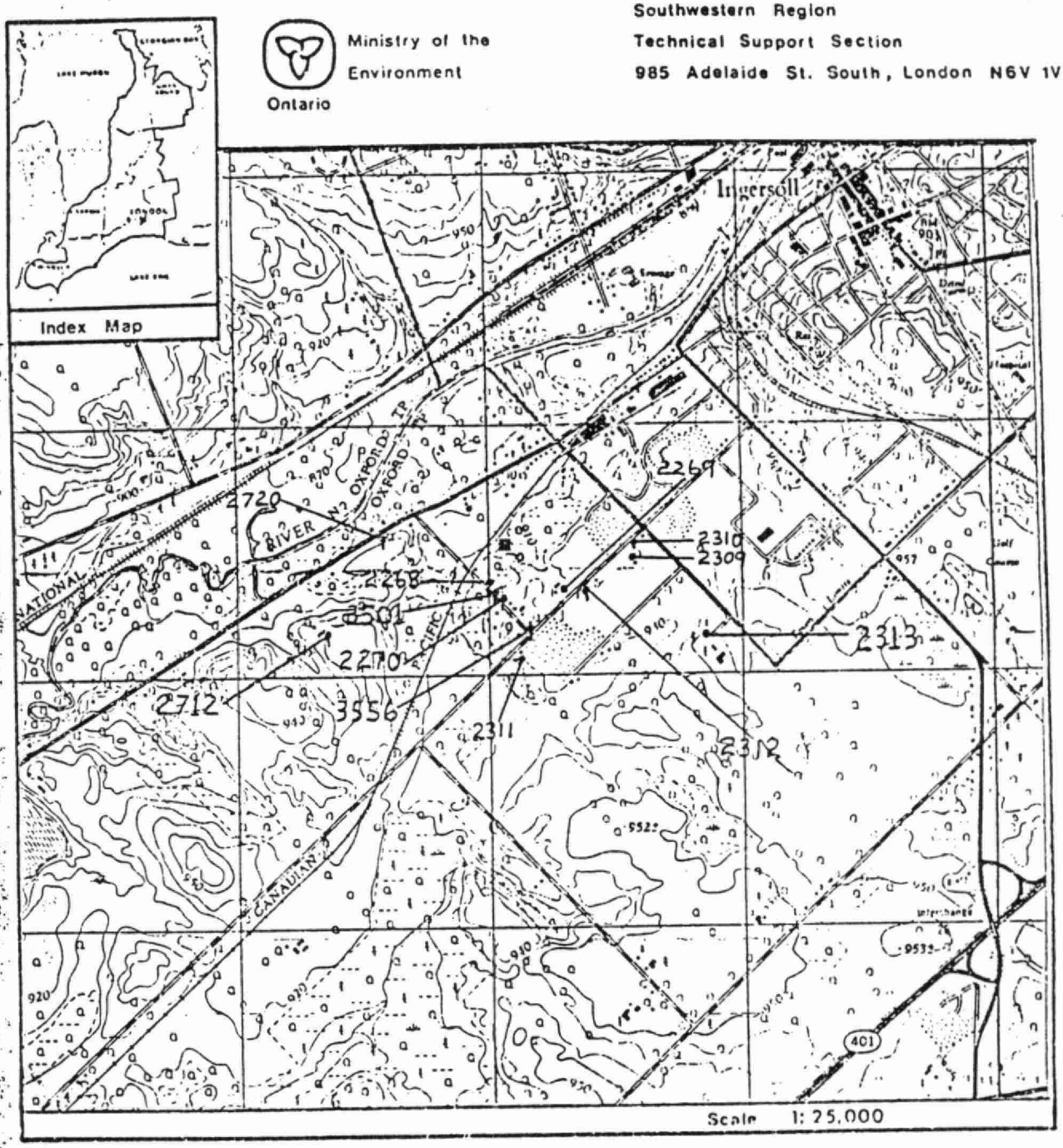
   (ii) West Oxford Well No. 3 - Drawing A-77467

   This well was under routine use during the test of No. 7 Well. Water levels were observed randomly at the times noted. Again we have no confidence that No. 7 pumpage could be shown to have affected No. 3 well levels. The random levels observed

.....2/

Ministry of the Environment
Ontario

Southwestern Region
Technical Support Section
985 Adelaide St. South, London N6V 1V3



Legend

- Drilled overburden well
- Drilled bedrock well
- —2340 Water well number; record on file with M.O.E.
- Location of proposed production well

Lot 23 Concession Broken Front; W. Oxford Twp.

FIGURE 1. MAP SHOWING THE LOCATION OF THE PROPOSED INGERSOL P.U.C. PRODUCTION WELL; LOT 23, BROKEN FRONT CONCESSION TOWNSHIP OF WEST OXFORD, AND LOCAL WATER WELLS.

Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

County or District	Township, Borough, City, Town, Village	Con., Block, Tract, Survey, etc.	Lot
OXFORD	Ingersoll		

Owner (Surname First)	Address	Date Completed
[illegible] Utilities Commission	1[illegible] [illegible] St. Ingersoll Ont.	day 26 mo Sept. 197[illegible]

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

General Colour	Most Common Material	Other Materials	General Description	Depth – Feet From	To
	Clay	Boulders		6	15
	"	Gravel, Boulders		15	22
[illegible]	"			22	37
	Sand	Gravel, Boulders, Clay		37	42
	Clay	" "		42	63
	Sand	Gravel		63	67
[illegible]	Limestone	[illegible] streaks to [illegible] / [illegible] + [illegible] / Grey strks [illegible]	[illegible]	67	240
Grey	"			240	245
Brown	"	white & black streaks		245	273
Grey	"	Brown strks [illegible] / white strks [illegible]	hard	273	322
[illegible] Brown	"	white streaks		322	344
[illegible]	"	[illegible]		344	373
[illegible]	"		hard	373	[illegible]

WATER RECORD

Water Found at – Feet	Kind of Water
[illegible] 67	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
[illegible]	☐ Fresh ☒ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral
	☐ Fresh ☐ Sulphur ☐ Salty ☐ Mineral

CASING & OPEN HOLE RECORD

Inside Diam. Inches	Material	Wall Thickness Inches	Depth – Feet From	To
13 ½	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open Hole	.375	+2.5	132
12 ¼	☐ Steel ☐ Galvanized ☐ Concrete ☒ Open Hole		132	315
10	☐ Steel ☐ Galvanized ☐ Concrete ☒ Open Hole		315	4[illegible]

SCREEN

Size of Opening (Slot No.)	Diameter	Length
	inches	feet
Material and Type	Depth to Top of Screen	feet

PLUGGING & SEALING RECORD

Depth Set at – Feet From	To	Material and Type (Cement Grout, Lead Packer, etc.)
0	132	[illegible] Bentonite [illegible] / [illegible] Grout [illegible]

PUMPING TEST

Pumping Test Method	Pumping Rate	Duration of Pumping
☒ Pump ☐ Bailer	700 GPM	2[illegible] hrs

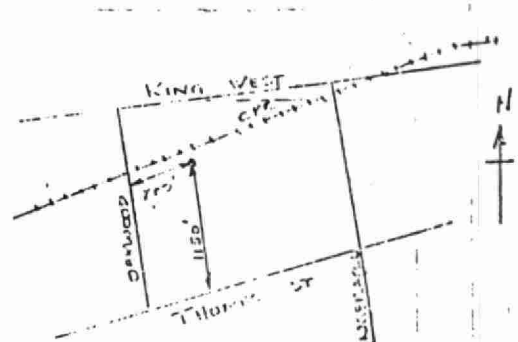
Static Level	Water Level End of Pumping	Water Levels During: 15 minutes	30 minutes	45 minutes	60 minutes
43.28 feet	61.57 feet	50.35 feet	51.35 feet	—	52.3[illegible] feet

If Flowing Give Rate	Pump Intake Set At	Water at End of Test
GPM	feet	☒ Clear ☐ Cloudy

Recommended Pump Type	Recommended Pump Setting	Recommended Pumping Rate
☐ Shallow ☒ Deep	100 feet	700 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



Driller's Remarks:

FINAL STATUS OF WELL	☒ Water Supply ☐ Observation Well ☐ Test Hole ☐ Recharge Well ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Quality ☐ Unfinished
WATER USE	☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Other ☐ Commercial ☒ Municipal ☐ Public Supply ☐ Cooling or Air Conditioning ☐ Not Used
METHOD OF DRILLING	☐ Cable Tool ☐ Rotary (Conventional) ☐ Rotary (Reverse) ☒ Rotary (Air) ☐ Air Percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving

Name of Well Contractor	Licence Number
International Water Supply Ltd	2801

Address: Box 310 Barrie

Name of Driller or Borer: A. Grimster

Signature of Contractor: [signature]

Submission Date: day 2[illegible] mo [illegible] 197[illegible]

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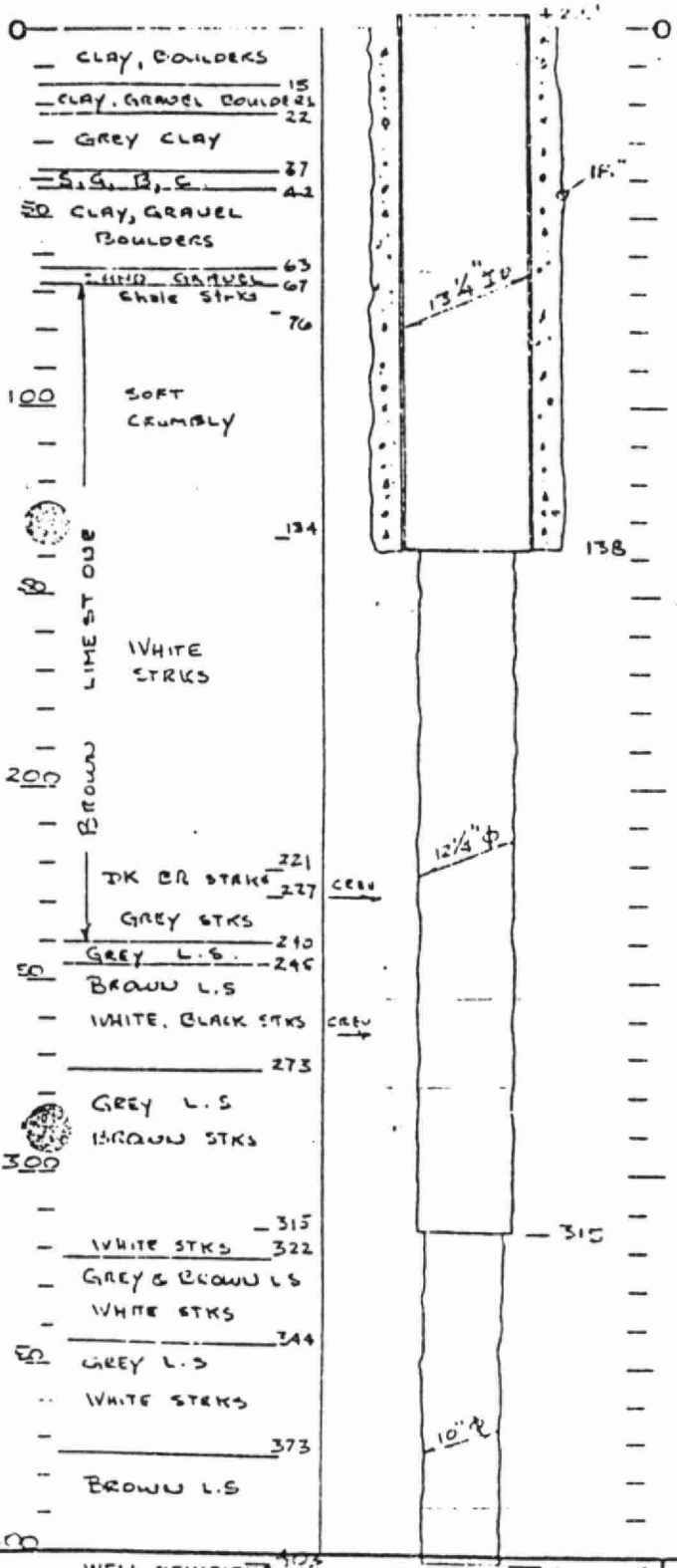
FORM NO. 0506

WELL DIAGRAM

LOG



WELL MATERIAL

Outer Casing: 14 " dia. .375" Wall Thk. Matl.: STL

Cemented from 1'6" to 0'0"

Inner Casing: — " dia. — " Wall Thk. Matl.: —

Screen: Make. — " dia., Opening & Matl.: —

Plug: Type —, Matl —, Other: —

Gravel: Type. —, Size —, Quantity —

WELL TEST DATA

Preliminary Test Date: SEPT 30-31/77 by A.G.

Static Level: 43.28' " below M.P. (-)0.16'

Pumping Rate IGM: 700 IGM

Pumping Duration: 240 hrs. 0 min.

Pumping Level at Test End: 91.27' "

Performance Plots: dd-t Dwg. B-77465

dd-t Dwg.

Step Test: Dwg. B-77433

Final Test: Date — by —

Rated Well Capacity IGM —

Pumping Rate IGM — Static level — ' — "

Pumping level — ' — " at — hrs. — min.

Pump pressure: — psi; Main pressure — psi

Shut off: AGH — psi, W.L. — ' — "

Clear Well Depth from B.P. — ' — " Air Line — ' — "

PUMP & MOTOR DATA

Pump Make — Rating — IGM @ — ' TH

Head: Type — S.N. —

Column: — ' X — " X — "; Shaft Mtl: —

Bowl: — Stage — Curve: —

Suction: — " dia. — ' — " Long

Special: Zinc Sleeves —; Taped Oil Line —

Other —

Motor Make: — Frame: — SN: —

— HP, — ph, — hz, — rpm

Bearing No. Upper —

Lower —

Special Equipment

—

—

—

—

—

WELL REVISIONS AND REHABILITATION

DATE	WORK DONE	BY

International Water Supply Limited

SASKATOON - BARRIE - MONTREAL

CLIENT: INGERSOLL ONT

WELL NO: No 1

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

4706144
PAGE 1 OF 2

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN OR VILLAGE	LOT	CONCESSION
Oxford	Ingersoll (West Oxford)	24	II

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Town of Ingersoll	143 Bell St Ingersoll	Oct 21 / 87

Page #1

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
	Topsoil			0	1
	Sand Gravel & Clay			1	6
	Gravel	boulders, sand, brown clay		6	20
	Gravel	sand, brown clay		20	27
rown	clay	boulders	stoney	27	35
	Gravel	boulders sand		35	43
	Gravel	sand boulders		43	85
	Gravel	boulders grey clay		85	89
rey	clay	few boulders	hard stoney	89	98
rey	clay	few stirks sand & gravel	stoney	98	104
rey	clay	sd	stoney	104	118
	Sand.			118	121

WATER RECORD

WATER FOUND AT FEET	KIND OF WATER
28-380	☑ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FEET FROM	DEPTH FEET TO
15¼	☑ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE	.375	0	140
12¼	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☑ OPEN HOLE		140	319
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			

SCREEN

SIZE OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER ETC.)
140	0	cement grout

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
☑ PUMP ☐ BAILER	700 GPM	24 HOURS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING PUMPING ☐ RECOVERY: 15 MINUTES	20 MINUTES	45 MINUTES	60 MINUTES
18.55 FEET	118.41 FEET	110.17	111.18		12.32

IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	FEET	☐ CLEAR ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP

RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
FEET	GPM

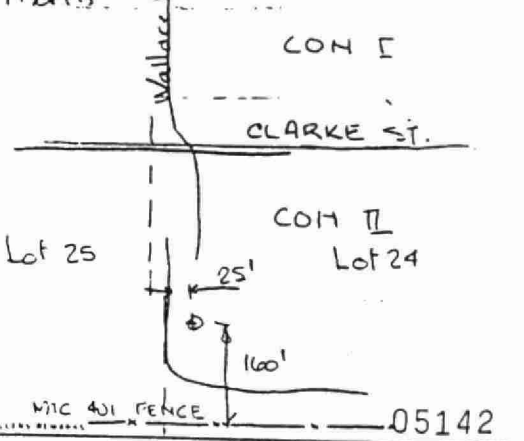
FINAL STATUS OF WELL: ☑ WATER SUPPLY ☐ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL ☐ ABANDONED INSUFFICIENT SUPPLY ☐ ABANDONED POOR QUALITY ☐ UNFINISHED

WATER USE: ☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ OTHER ☐ COMMERCIAL ☑ MUNICIPAL ☑ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☐ NOT USED

METHOD OF DRILLING: ☐ CABLE TOOL ☑ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☐ AIR PERCUSSION ☐ BORING ☐ DIAMOND ☐ JETTING ☐ DRIVING — 2801

LOCATION OF WELL 1L (4/87)

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW



NAME OF WELL CONTRACTOR	LICENCE NUMBER
International Water Supply	2801

ADDRESS: PO Box 310 Barrie

NAME OF DRILLER OR MOLER	WELL RECORD
A Grivister	T 0120

SIGNATURE OF CONTRACTOR: [signature]

COMPLETION DATE: DAY 11 / MO 2 / 87

OFFICE USE ONLY: NOV 17 1987

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506-6-77(C)

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

4706144

PAGE 2 OF 2

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COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	BLOCK TRACT SURVEY ETC	LOT
Oxford	Ingersoll (West Oxford Tp)	II	24

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Town of Ingersoll	143 Bell St Ingersoll	Day 21 Mo 8 Yr 87

Page # 2

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	TO
grey	clay	few stnks sand & gravel	stoney	121	128
brown	limestone	sandy	very soft	128	134
brown	limestone			134	139
grey	limestone			139	141
brown	limestone		hard	141	209
brown	limestone		softer some rough strk.	209	285
brown	limestone	grey strk stnks of blk shale	hard	285	309
brown & grey	limestone	strks of soft grey shale		309	349
brown & grey	limestone			349	366
grey	limestone	or shale softer		366	372
brown	limestone		soft	372	376
grey	limestone	or shale	hard	376	380
blue	shale			380	391

31
32

51 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
	FRESH SULPHUR / SALTY MINERAL
	FRESH SULPHUR / SALTY MINERAL
	FRESH SULPHUR / SALTY MINERAL
	FRESH SULPHUR / SALTY MINERAL
	FRESH SULPHUR / SALTY MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WT PER FOOT INCHES	DEPTH FEET FROM	TO
13"	STEEL GALVANIZED CONCRETE OPEN HOLE			
	STEEL GALVANIZED CONCRETE OPEN HOLE			

SCREEN

SIZE OF OPENING SLOT NO.	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

61 PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM TO | MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER ETC.)

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMP TEST
PUMP BAILER	GPM	HRS MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING			
		10 MINUTES	20 MINUTES	30 MINUTES	40 MINUTES
FEET	FEET	FEET	FEET	FEET	FEET

IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	FEET	CLEAR CLOUDY
RECOMMENDED PUMP TYPE: SHALLOW DEEP	RECOMMENDED PUMP SETTING FEET	RECOMMENDED PUMPING RATE GPM

FINAL STATUS OF WELL	WATER SUPPLY; OBSERVATION WELL; TEST HOLE; RECHARGE WELL; ABANDONED INSUFFICIENT SUPPLY; ABANDONED POOR QUALITY; UNFINISHED
WATER USE	DOMESTIC; STOCK; IRRIGATION; INDUSTRIAL; OTHER; COMMERCIAL; MUNICIPAL; PUBLIC SUPPLY; COOLING OR AIR CONDITIONING; NOT USED
METHOD OF DRILLING	CABLE TOOL; ROTARY (CONVENTIONAL); ROTARY (REVERSE); ROTARY (AIR); AIR PERCUSSION; BORING; DIAMOND; JETTING; DRIVING 2801

LOCATION OF WELL 11 (4787)

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

See Page # 1

DRILLER'S REMARKS 05143

NAME OF WELL CONTRACTOR	CONTRACTOR'S LICENCE NUMBER
International Water Supply	2801
ADDRESS: P.O. Box 310 Barrie	
NAME OF DRILLER OR BORER: A. Grimoster	T 0120
SIGNATURE OF CONTRACTOR: [signature]	DATE: Day 11 Mo 9 Yr 87

OFFICE USE ONLY: NOV 17 1987

MINISTRY OF THE ENVIRONMENT COPY

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

4706161

PAGE 1 OF 3

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COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN OR VILLAGE	BLOCK/TRACT SURVEY ETC.	LOT
Oxford	West Oxford	II	23
OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED	
INGERSOLL PUC	143 Bell St Ingersoll	DAY 22 MO 5 YR 87	

Page #1

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
	Sand	stones		0	10
	Sand	some Gravel		10	19
	Sand	gravel bldrs		19	41
grey	Sand	gravel bldr some clay		41	51
	Gravel	bldrs & clay		51	57
	clay	stoney few bldrs	hard	57	92
grey	clay	few stones	hard.	92	100
grey	clay	gravel bldrs	hard	100	110
grey	gravel	clay		110	121
	Sand	gravel	packed	121	127
	gravel & bldrs		packed & cemented	127	131
	gravel	sand bldr	loose	131	135

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FEET FROM	DEPTH FEET TO
20"	☑ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE	.375	0	60
14"	☑ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE	.375	0	149
12"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☑ OPEN HOLE			

SCREEN

SLOT NO.	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
149	0	Grout

PUMPING TEST

PUMPING TEST METHOD: ☐ PUMP ☐ BAILER

PUMPING RATE: 800 GPM

DURATION OF PUMPING: 24 HRS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVEL DURING: ☑ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
86.82 FEET	131.38 FEET	122.06 FEET	123.06 FEET		124.25 FEET

IF FLOWING GIVE RATE: GPM

PUMP INTAKE SET AT: FEET

WATER AT END OF TEST: ☐ CLEAR ☐ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP

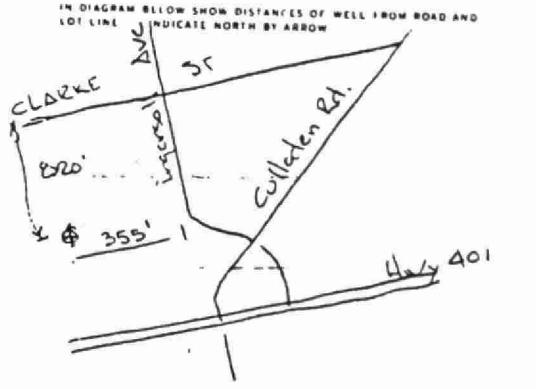
RECOMMENDED PUMP SETTING: FEET

RECOMMENDED PUMPING RATE: GPM

FINAL STATUS OF WELL	☑ WATER SUPPLY ☐ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL ☐ ABANDONED INSUFFICIENT SUPPLY ☐ ABANDONED POOR QUALITY ☐ UNFINISHED
WATER USE	☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ COMMERCIAL ☑ MUNICIPAL ☐ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☐ OTHER ☐ NOT USED
METHOD OF DRILLING	☐ CABLE TOOL ☑ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☐ AIR PERCUSSION ☐ BORING ☐ DIAMOND ☐ JETTING ☐ DRIVING 2801

LOCATION OF WELL # 10

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW



DRILLERS REMARKS

02350

NAME OF WELL CONTRACTOR	LICENCE NUMBER
International Water Supply	2801
ADDRESS: PO Box 310 Barrie	
NAME OF DRILLER OR BORER	LICENCE NUMBER
A. Grimster	T0120
SIGNATURE OF CONTRACTOR	SUBMISSION DATE: DAY 29 MO 5 87

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Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

4706161

PAGE 2 OF 3

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COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	BLOCK, TRACT, SURVEY, ETC.	LOT	CONCESSION
Oxford	West Oxford	II	23	

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
INGERSOLL PUC	143 Bell St Ingersoll	DAY MO YR

Page 2 of 3

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
grey	clay		hard stoney	135	141
	limestone		weathered	141	142
grey	limestone		hard	142	146
brown	limestone		hard	146	154
grey	limestone			154	161
brown	limestone	strks grey limestone		161	174
lt brown	limestone			174	185
	limestone	blk strks + light strks		185	189
brown	limestone			189	210
brown	limestone	grey strks		210	215
brown	limestone	few black shale ~~of~~ or L.S strks fairly hard		215	249
brown	limestone		soft many rough strks	249	290

51 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

52 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FEET FROM	DEPTH FEET TO
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SCREEN NO.	DIAMETER INCHES	LENGTH

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN

61 PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☐ PUMP 2 ☐ BAILER	GPM	HOURS MIN

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING	1 ☐ PUMPING 2 ☐ RECOVERY
FEET	FEET	15 MINUTES / 30 MINUTES / 45 MINUTES / 60 MINUTES	FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	RECOMMENDED PUMP SETTING FEET	1 ☐ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP		RECOMMENDED PUMPING RATE GPM

FINAL STATUS OF WELL	☑ WATER SUPPLY; ☐ OBSERVATION WELL; ☐ TEST HOLE; ☐ RECHARGE WELL; ☐ ABANDONED, INSUFFICIENT SUPPLY; ☐ ABANDONED, POOR QUALITY; ☐ UNFINISHED
WATER USE	☐ DOMESTIC; ☐ STOCK; ☐ IRRIGATION; ☐ INDUSTRIAL; ☐ COMMERCIAL; ☑ MUNICIPAL; ☐ PUBLIC SUPPLY; ☐ COOLING OR AIR CONDITIONING; ☐ OTHER; ☐ NOT USED
METHOD OF DRILLING	☐ CABLE TOOL; ☑ ROTARY (CONVENTIONAL); ☐ ROTARY (REVERSE); ☐ ROTARY (AIR); ☐ AIR PERCUSSION; ☐ BORING; ☐ DIAMOND; ☐ JETTING; ☐ DRIVING 2801

LOCATION OF WELL # 10

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

DRILLERS REMARKS: 05132

NAME OF WELL CONTRACTOR	LICENCE NUMBER
International Water Supply	2801
ADDRESS: P.O. Box 310 Barrie	
NAME OF DRILLER OR BORER: A Grimster	LICENCE NUMBER: T 0120
SIGNATURE OF CONTRACTOR: [signature]	DATE: 29 - 5 - 87

OFFICE USE ONLY: NOV 17 1987

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

4706161

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PAGE 3 OF 3

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Oxford	West Oxford	II	23

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
INGERSOLL P.U.C.	143 Bell St Ingersoll	DAY 22 MO. 5 YR. 8[illegible]

Page 4

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
brown	limestone		hard	290	305
brown	limestone	gray strks	very hard	305	351
grey	limestone		soft	351	358
L. brown	limestone		very hard	358	365
L. grey	limestone	soft strks brown strks		365	369

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE			

SCREEN

SIZE OF OPENING (SLOT NO.) | DIAMETER INCHES | LENGTH FEET
MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

PUMPING TEST METHOD ☐ PUMP ☐ BAILER | PUMPING RATE GPM | DURATION OF PUMPING HRS MINS
STATIC LEVEL | WATER LEVEL END OF PUMPING | WATER LEVELS DURING ☐ PUMPING ☐ RECOVERY: 15 MINUTES, 30 MINUTES, 45 MINUTES, 60 MINUTES (FEET)
IF FLOWING GIVE RATE GPM | PUMP INTAKE SET AT FEET | WATER AT END OF TEST ☐ CLEAR ☐ CLOUDY
RECOMMENDED PUMP TYPE ☐ SHALLOW ☐ DEEP | RECOMMENDED PUMP SETTING FEET | RECOMMENDED PUMPING RATE GPM

LOCATION OF WELL #10

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW

FINAL STATUS OF WELL
☒ WATER SUPPLY
☐ OBSERVATION WELL
☐ TEST HOLE
☐ RECHARGE WELL
☐ ABANDONED, INSUFFICIENT SUPPLY
☐ ABANDONED, POOR QUALITY
☐ UNFINISHED

WATER USE
☐ DOMESTIC
☐ STOCK
☐ IRRIGATION
☐ INDUSTRIAL
☐ OTHER
☐ COMMERCIAL
☒ MUNICIPAL
☐ PUBLIC SUPPLY
☐ COOLING OR AIR CONDITIONING
☐ NOT USED

METHOD OF DRILLING
☒ CABLE TOOL
☒ ROTARY (CONVENTIONAL)
☐ ROTARY (REVERSE)
☐ ROTARY (AIR)
☐ AIR PERCUSSION
☐ BORING
☐ DIAMOND
☐ JETTING
☐ DRIVING

2801

DRILLERS REMARKS

05133

NAME OF WELL CONTRACTOR: International Water Supply | LICENCE NUMBER: 2801
ADDRESS: P.O. Box 310
NAME OF DRILLER OR BORER: D. Pinnister | LICENCE NUMBER: T1720
SIGNATURE OF CONTRACTOR: [signature] | SUBMISSION DATE: DAY 21 MO. 5 YR. 87

OFFICE USE ONLY

NOV 17 1987

Ingersoll P.U.C.

Ontario

Ministry of the Environment

985 Adelaide Street South
London, Ontario
N6E 1V3
681-3600

P.W. at intersection of Canterbury Street & Hwy. No. 19
Town of Ingersoll, Oxford County

RENEWAL
PERMIT TO TAKE WATER

Your Permit to Take Water No. 70-P-203, originally issued July 13, 1970, is renewed with the changes requested by you in your recent Renewal Application as follows:

Your Permit to Take Water is renewed subject to the General Terms and Conditions (overleaf) which replace all General and ~~Special Terms~~ and Conditions on the previous Permit. Further, your Permit to Take Water is subject to the following additional conditions imposed by the Director:

This Renewal Permit to Take Water will expire March 31, 1990 and will be subject to a further renewal at that time.

Notice of Terms and Conditions
The Ontario Water Resources Act, Section 79

Take notice that in issuing this Permit to Take Water, I have imposed terms and conditions pertaining to the taking of water and to the results of the taking. The terms and conditions have been designed to allow for the development of water resources for beneficial purposes while providing reasonable protection to existing water uses and to public interests in water.

You may appeal the terms and conditions by giving written notice to the Director of the Ministry at the address above, and to the Environmental Appeal Board, 1 St. Clair Avenue West, Toronto, Ontario M4V 1K6, within fifteen days after service of this Notice. In the event of an appeal, the terms and conditions of the Permit, as issued, would remain in effect until the appeal has been finalized.

Date: 14 7 89
D M Y

[signature]
Signature of Director

MOE 1615/80

(over)

Dated at Toronto this 13th day of July 19 70

ONTARIO WATER RESOURCES COMMISSION

D.J. COLLINS
Chairman

[signature] for A.K. WATT
Assistant General Manager

L. Erie
Thames R.
Trib.

Water management in Ontario

Ontario
Water Resources
Commission

ORIGINAL
ON JUL 13 1970
(Signed)
Permit
To Take Water

No. 70-P-203

Under section 28a of The Ontario Water Resources Commission Act this permit is issued to

Ingersoll Public Utilities Commission

whose address for all purposes pertaining to this permit is

143 Bell Street, P.O. Box 157, Ingersoll, Ontario

for the taking of water in accordance with the terms and conditions set out below and on the back of this form.

TERMS AND CONDITIONS

PARTICULARS

SOURCE: Well No. 5

LOCATION: Southwest of the intersection of Caterbury Street and Highway No. 19 in the Town of Ingersoll, County of Oxford.

PURPOSE: Municipal Water Supply

PERIOD: From date of issue To March 31, 1980 Inclusive

RATE NOT TO EXCEED: 500 Imperial Gallons Per Minute. Subject to Special Condition No. 1.

AMOUNT NOT TO EXCEED: 715,000 Imperial Gallons Per Day. Subject to Special Condition No. 1.

SPECIAL

1. If the taking of water under this permit interferes seriously with other water supplies obtained from any adequate sources that were in use prior to the date of this permit, the permittee shall make available or take such action as will make available to those affected an amount of water equal to their normal takings under terms and conditions that the Ontario Water Resources Commission deems fair, or shall reduce the rate and amount of taking so that any serious interference is eliminated.

Dated at Toronto this 13th day of July 19 70

ONTARIO WATER RESOURCES COMMISSION

D.J. COLLINS
Chairman

Fred A. Virgo
for A.K. WATT
Assistant General Manager

Ontario

Ministry
of the
Environment

985 Adelaide Street South
London, Ontario
N6E 1V3
681-3600

INGERSOLL P.U.C

RENEWAL
PERMIT TO TAKE WATER

Your Permit to Take Water 72-P-232, originally issued August 14, 1972, is renewed with the changes requested by you in your recent Renewal Application as follows:

Your Permit to Take Water is renewed subject to the General Terms and Conditions (overleaf) which replace all General and Special Terms and Conditions on the previous Permit. Further, your Permit to Take Water is subject to the following additional conditions imposed by the Director:

This Renewal Permit to Take Water will expire March 31, 1992 and will be subject to a further renewal at that time.

Notice of Terms and Conditions
The Ontario Water Resources Act, Section 79

Take notice that in issuing this Permit to Take Water, I have imposed terms and conditions pertaining to the taking of water and to the results of the taking. The terms and conditions have been designed to allow for the development of water resources for beneficial purposes while providing reasonable protection to existing water uses and to public interests in water.

You may appeal the terms and conditions by giving written notice to the Director of the Ministry at the address above, and to the Environmental Appeal Board, 1 St. Clair Avenue West, Toronto, Ontario M4V 1K6, within fifteen days after service of this Notice. In the event of an appeal, the terms and conditions of the Permit, as issued, would remain in effect until the appeal has been finalized.

Date:
12 2 82
D M Y

Longworth
Signature of Director

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED

ON August 14, 1972

H. A. Martin
(Signed)

Ministry of the Environment

PERMIT TO TAKE WATER

No. 72-P-232

Under section 37 of The Ontario Water Resources Act this permit is issued to

Ingersoll Public Utilities Commission

whose address for all purposes pertaining to this permit is

143 Bell Street, P.O. Box 157, Ingersoll, Ontario

for the taking of water in accordance with the terms and conditions set out below and on the back of this form.

TERMS AND CONDITIONS

PARTICULARS

SOURCE: Merritt Street Well No. 3 (Public Utilities Commission Well No. 6)

LOCATION: Near the intersection of Frances and Wonham Streets, Town of Ingersoll, County of Oxford.

PURPOSE: Municipal supply

PERIOD: From date of issue To March 31, 1982 Inclusive

RATE NOT TO EXCEED: 400 Imperial gallons per minute, Subject to Special Condition No. 1.

AMOUNT NOT TO EXCEED: 576,000 Imperial gallons in a day. Subject to Special Condition No. 1.

SPECIAL

1. If the taking of water under this permit is forecast to interfere seriously or is observed to interfere seriously with other water supplies obtained from any adequate sources that were in use prior to the date of this permit, the permittee shall take such action as will make available to those affected a supply of water equivalent to their normal takings under terms and conditions that the Executive Director, Water Resources, deems fair or shall reduce the rate and amount of taking so as to prevent the forecast interference or alleviate the observed interference. Pending permanent restoration of affected water supplies, the permittee shall provide to those affected sufficient potable, temporary water supplies to meet their normal requirements.

Dated at Toronto this 14th day of August 19 72

Executive Director, Water Resources,
Ministry of the Environment

MOE 02-014/5/72

WDR Dist. of Frances & Wonham Sts Ingersoll

#47
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ONTARIO

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Ministry of the Environment

PERMIT TO TAKE WATER

V February 5, 1974

M. A. Martin
(Signed)

RENEWAL
No. 64-P-33

Under section 37 of The Ontario Water Resources Act this permit is issued to

Ingersoll Public Utilities Commission

whose address for all purposes pertaining to this permit is

143 Bell Street, Ingersoll, Ontario

for the taking of water in accordance with the terms and conditions set out below and on the back of this form.

TERMS AND CONDITIONS

PARTICULARS

SOURCE: One Well

LOCATION: Lot 13, concession 4, Township of North Oxford, County of Oxford

PURPOSE: Municipal Supply

PERIOD: From date of issue To March 31, 1984 Inclusive

RATE NOT TO EXCEED: 500 Imperial gallons per minute.
Subject to Special Condition No. 1.

AMOUNT NOT TO EXCEED: 720,000 Imperial gallons in a day.
Subject to Special Condition No. 1.

SPECIAL

1. If the taking of water under this renewal permit is forecast to interfere seriously or is observed to interfere seriously with other water supplies obtained from any adequate sources that were in use prior to the date of the original permit, the permittee shall take such action as will make available to those affected a supply of water equivalent to their normal takings under terms and conditions that the Executive Director, Water Resources, deems fair or shall reduce the rate and amount of taking so as to prevent the forecast interference or alleviate the observed interference. Pending permanent restoration of affected water supplies, the permittee shall provide to those affected sufficient potable, temporary water supplies to meet their normal requirements.

Dated at Toronto this 5 day of February 19 74

K. H. S Layne

Executive Director, Water Resources,
Ministry of the Environment

MOE 02-014/5/72

07-101/5/72

Ministry of the Environment - Ministère de l'Environnement

Ontario

135 St. Clair Avenue West
Suite 100
Toronto, Ontario
M4V 1P5

135 ouest, avenue St. Cl
Bureau 100
Toronto (Ontario)
M4V 1P5

THIS IS A TRUE COPY OF THE ORIGINAL

RENEWAL
PERMIT TO TAKE WATER

Your Permit to Take Water 78-P-1091, originally issued November, 1978, is renewed with the changes requested by you in your recent Renewal Application as follows:

Your Permit to Take Water is renewed subject to the General Terms and Conditions (overleaf) which replace all General and Special Terms and Conditions on the previous Permit. Further, your Permit to Take Water is subject to the following additional conditions imposed by the Director:

This Renewal Permit to Take Water will expire March 31, 1998 and will be subject to a further renewal at that time.

Notice of Terms and Conditions
The Ontario Water Resources Act, Section 61

Take notice that in issuing this Permit to Take Water, I have imposed terms and conditions pertaining to the taking of water and to the results of t taking. The terms and conditions have been designed to allow for the development of water resources for beneficial purposes while providing reasonabl protection to existing water uses and to public interests in water.

You may appeal the terms and conditions by giving written notice to the Director of the Ministry at the address above, and to the Environmental Appeal Board, 1 St. Clair Avenue West, Toronto, Ontario M4V 1K6, within fifteen days after service of this Notice. In t event of an appeal, the terms and conditions of the Permit, as issued, would remain in effect until the appeal has been finalized.

Date:

Ministry of the Environment

Ontario

PERMIT TO TAKE WATER

No. 78-P-1091

Under section 37 of The Ontario Water Resources Act this permit is issued to

Town of Ingersoll (Public Utilities Commission)

whose address for all purposes pertaining to this permit is

P.O. Box 157, Ingersoll, Ontario.

for the taking of water in accordance with the terms and conditions set out below and on the back of this form.

THIS IS A TRUE COPY OF THE ORIGINAL

TERMS AND CONDITIONS

PARTICULARS

SOURCE: One Drilled Well (Well No.7)

LOCATION: Town of Ingersoll, Part Lot 1 Registered Plan #44 in the County of Oxford

PURPOSE: Municipal

PERIOD: From date of issue To March 31, 1988 Inclusive

RATE NOT TO EXCEED: 700 Imperial gallons per minute - subject to Special Condition No. 1

AMOUNT NOT TO EXCEED: 1,000,000 Imperial gallons per day - subject to Special Condition No. 1.

SPECIAL

1. If the taking of water under this permit is forecast to interfere seriously or is observed to interfere seriously with other water supplies obtained from any adequate sources that were in use prior to the date of this permit, the permittee shall take such actions as will make available to those affected a supply of water equivalent to their normal takings under terms and conditions that the Director deems fair or shall reduce the rate and amount of taking so as to prevent the forecast interference or alleviate the observed inteference. Pending permanent restoration of affected water supplies, the permittee shall provide to those affected sufficient potable, temporary water supplies to meet their normal requirements.

Dated at London this fourteenth day of November 19 72

O.C.T.O.

Ministry of the Environment

Ontario

PERMIT TO TAKE WATER

No. 80-P-1013

Under section 37 of The Ontario Water Resources Act this permit is issued to Ingersoll Public Utility Commission

whose address for all purposes pertaining to this permit is 143 Bell Street, P. O. Box 157, Ingersoll, Ontario

for the taking of water in accordance with the terms and conditions set out below and on the back of this form.

TERMS AND CONDITIONS

PARTICULARS

SOURCE: One drilled well - Well #8

LOCATION: Part of Lot 12, Concession III, Township of Zorra, (formerly North Oxford), County of Oxford.

PURPOSE: Municipal Water Supply - Town of Ingersoll

PERIOD: From date of issue To March 31, 1990 Inclusive

RATE NOT TO EXCEED: 37.88 litres per second, subject to Special Condition No. 1

AMOUNT NOT TO EXCEED: 3,250,390 litres per day, subject to Special Condition No. 1

1. SPECIAL For Ground-Water Takings, if the taking of water is forecast to interfere seriously, or is observed to interfere seriously with other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit holder shall take such action as will m available to those affected a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall re the rate and amount of taking so as to prevent the forecast interference or alleviate the observed interference. Pending permanent restoration of the affected supplies, the Permit holde shall provide to those affected temporary water supplies adequat to meet their normal requirements, or shall compensate such persons for their reasonable costs of so doing.

Dated at Toronto this 17th day of April 19 80

Director

Ministry of the Environment
Ontario

Application for Permit to Take Water

The Ontario Water Resources Act, Section 20

Please Print in Block Letters

Ingersoll Public Utility Commission
Name of Applicant

P.O. Box 157,
Mailing Address

Ingersoll, Ontario.
City, Town . . . Etc. Prov.

Telephone: 519 485 1820
Area Number

N5C 3K5
Postal Code

Application Particulars

Please read instructions (Permit to Take Water Program Information Sheet)

A. Source of Water

1. Well: How many? 2 Spring: How many? -
2. Lake, Stream or River/Name -
3. Pond: How many? - Type: ☐ Dugout ☐ By-Pass ☐ On-Stream ☐ Pit or Quarry
4. Other: Type of Source -
5. Date of construction of source? Summer 1987 (D M Y) 6. Date of installation of water taking equipment? 1988 (D M Y)

B. Location of Taking: Well 10 Oxford Co. West Oxford Twp. Conc. II Lot 23
(Lot, Concession, Township and County or Region or District; or City, Town or Village with Street and Number)
Well 11 Oxford Co. West Oxford Twp. Conc. II Lot 24

C. Location of Water Use: Same as B ☐ or: Town of Ingersoll
(Lot, Concession, Township and County or Region or District; or City, Town or Village with Street and Number)

D. Purpose of Taking: ☐ Irrigation ☐ Commercial ☐ Industrial ☒ Municipal ☐ Public Supply ☐ Recreation
☐ Other:

E. Period of Water Taking (Complete 1 or 2)

1. Taking to commence on 1988 (D M Y) and to extend for a period of years (Days, Weeks, Months, Years)
2. Seasonal taking to extend from (D M) to (D M) each year for Years

F. Request Amount of Taking from Each Source

	SOURCE 1	SOURCE 2	SOURCE 3
1. Source Name or Description	Well 10	Well 11	
2. Maximum Amount Taken in one Minute	700	700	
3. Maximum Amount Taken in One Day	1,000,000	1,000,000	
4. Number of Hours of Taking in One Day . . Maximum	24	24	
. . Average	-	-	
5. Maximum Number of Days of Taking in One Year	365	365	

State Units Used (check one)
- [X] Imperial Gallons Per Minute or Day
- [ ] U.S. Gallons Per Minute or Day
- [ ] Litres Per Minute or Day

G. Submit a diagram of the area of water use in the space provided on the reverse side of this form
(Diagram instructions and example are shown on the information sheet)

The applicant agrees to indemnify and save harmless the Crown in right of the Province of Ontario and its officers, employees, agents, and contractors from and against all damages, loss, costs, claims, suits, injuries, demands, actions, and proceedings resulting from or in any manner connected with any act or omission of the applicant or any of its officers, employees, agents or contractors and relating to this Application and any Permit, Renewal Permit, or terms and conditions of a Permit, issued in response to this Application.

I understand that it is the policy of the Director in issuing a Permit to Take Water to impose the General Terms and Conditions appearing on the reverse side of this Application. There are no special circumstances or reasons why the Director should not impose such terms and conditions in issuing the Permit I am applying for. (Note: Cross out the underlined sentence if it is not applicable to you and enclose with your Application a letter to the Director setting out such reasons and special circumstances.)

Date: 12 11 87 (D M Y)

Signature of Applicant or of Authorized Officer or Agent

THIS IS A TRUE COPY

(For Office Use Only)

Permit to Take Water

Permit Number: 86P1012

Permit Expires 31/03/98 (D M Y)

Pursuant to Section 20 of The Ontario Water Resources Act, permission is hereby granted for the taking of water in accordance with the above Application, subject to the General Terms and Conditions which appear overleaf, and subject to the Special Conditions and amendments to the Application Particulars, as follows:

Notice of Terms and Conditions

The Ontario Water Resources Act, Section 61

Take notice that in issuing this Permit to Take Water, I have imposed terms and conditions pertaining to the taking of water and to the results of the taking. The terms and conditions have been designed to allow for the development of water resources for beneficial purposes while providing reasonable protection to existing water uses and to public interests in water.

You may appeal the terms and conditions by giving notice [illegible]

LOT 23, 24 CON II W. OXFORD TWP. OXFORD COUNTY

General Terms and Conditions

These terms and conditions have been designed to allow for the development of water resources for beneficial purposes while providing reasonable protection of existing water uses and to public interests in water.

1. Permit

This Permit shall be kept available at all times for inspection.

2. Measurement and Reporting of Water Taking

The Director may, from time to time, where a situation of interference or anticipated interference with water supplies exists, or in a situation requiring information on takings for purposes of water resource inventory and planning, give written notice to the Permit holder to undertake any of the following actions.

The Permit holder shall comply with any such notice:

(a) To establish and maintain a system for the measurement of the quantities of water taken;

(b) To operate such a system and to record measurements of the quantities of water taken on forms provided by the Director, with such frequency or for such time periods as the Director may specify;

(c) To return to the Director records made pursuant to clause 2 (b) at such times or with such frequency as the Director may specify;

(d) To keep records made pursuant to clause 2 (b) available for inspection until such time as they are returned to the Director pursuant to clause 2 (c).

3. Interference with Other Water Supplies

The Permit holder shall immediately notify the Director of any complaint arising from the taking of water authorized by this Permit and shall report upon any action which has been taken or is proposed with regard to such complaint.

For Surface-Water Takings, the taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

For Ground-Water Takings, if the taking of water is forecast to interfere seriously, or is observed to interfere seriously with other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit holder shall take such action as will make available to those affected a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking so as to prevent the forecast interference or alleviate the observed interference. Pending permanent restoration of the affected supplies, the Permit holder shall provide to those affected temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of so doing.

4. Reporting of Changes

The Permit holder shall report to the Director any changes of address or telephone number, or change of ownership of the property for which this Permit is issued and shall report to the Director any changes in the general conditions of water taking from those described in the Permit application within thirty days of any such change.

The Permit holder shall not assign his rights under this Permit to another person without the written consent of the Director.

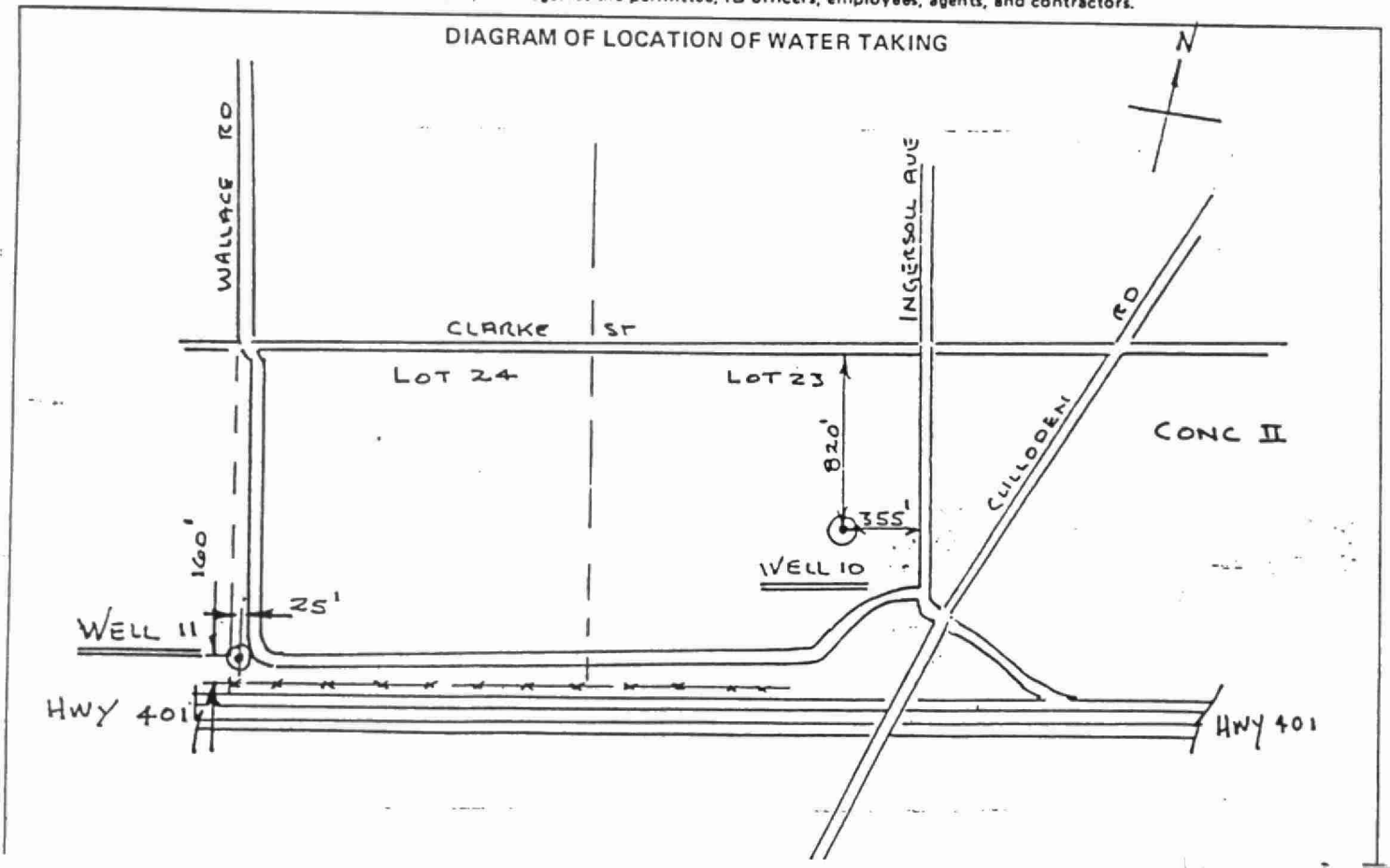
5. Expiry

No water may be taken under authority of this Permit after the expiry date shown on the face of this Permit, unless the Permit is renewed, or after the expiry date shown on any renewal of this Permit.

6. Liability

This Permit does not release the permittee from any legal liability or obligation and remains in force subject to all limitations, requirements, and liabilities imposed by law. This Permit shall not be construed as estopping or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the permittee, its officers, employees, agents, and contractors.

DIAGRAM OF LOCATION OF WATER TAKING



APPENDIX F

BH5-79 TROW INVESTIGATION

BOREHOLE LOG

JOB No. L 1279 BOREHOLE No. 5 DRAWING No. 6

PROJECT Proposed Plaza
LOCATION Charles Street
INGERSOLL, Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST
LAB VANE TEST

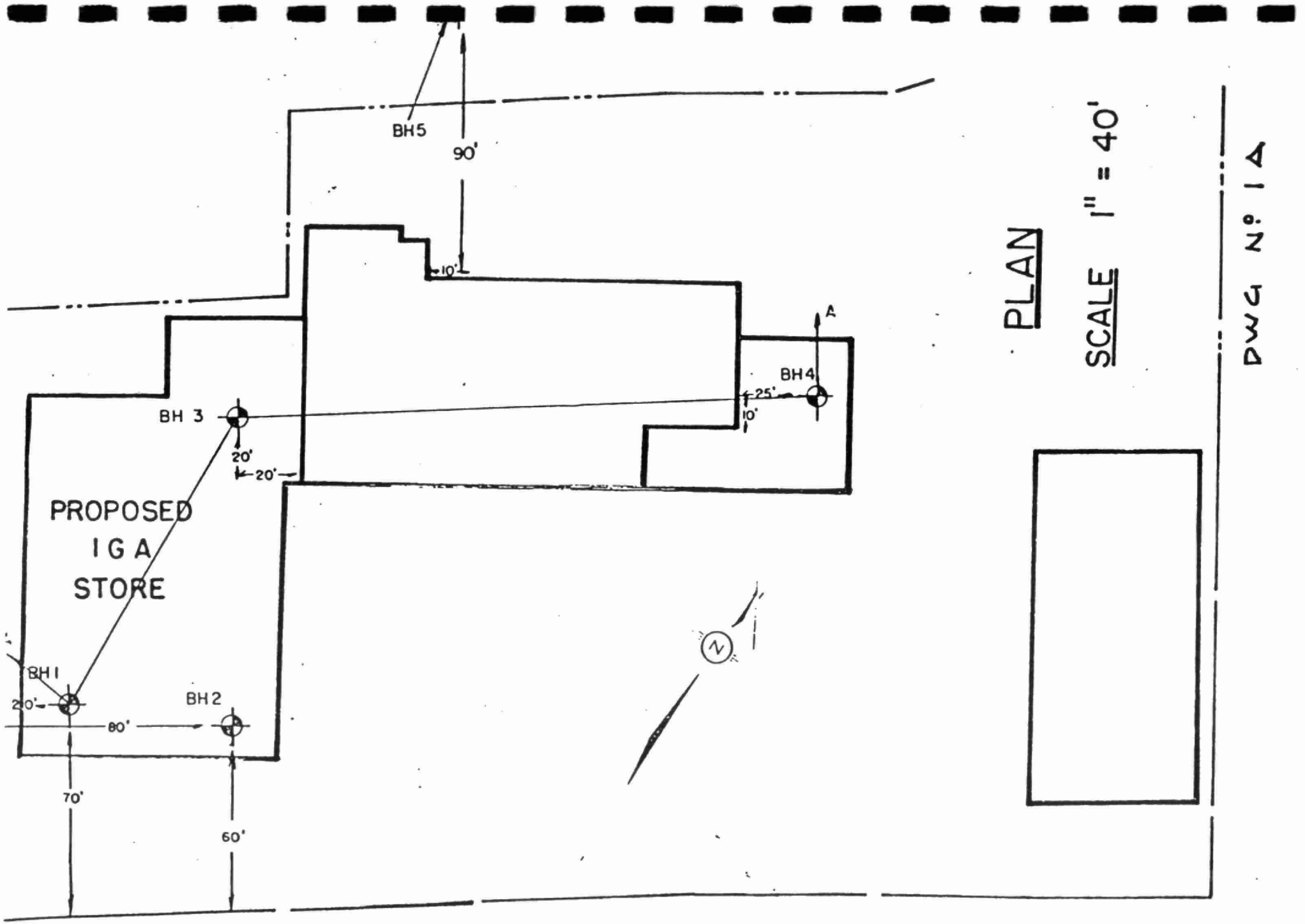
NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV (ft)	DEPTH (m)
	F	FILL - very loose to loose, silt sand, topsoil, etc.; heavily contaminated by oil	94.32 (309.5)	0
				1
				2
				3
			90.6 (297)	4
		SAND - loose to compact, fine to medium, uniform, brown, contaminated by oil to 4.5 m (i.e. to water table), wet below	89.8 (295)	5
				6
				7
		END OF BOREHOLE	86.7 (285)	8
		NOTES:		9
		1. Hole advanced by continuous flight auger on June 4th, 1979.		10
		2. Water level interpreted to lie at depth of 4.5 m.		

N VALUE (ASTM D1586-CSA A119.1)
SHEAR STRENGTH MPa
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
NATURAL UNIT WEIGHT kN/m³

G102U

THE TROW GROUP LIMITED


BH5
90'
10'
A
BH4
25'
10'
BH 3
20'
20'
PROPOSED
IGA
STORE
BH1
20'
BH2
80'
70'
60'
N
PLAN
SCALE 1" = 40'
DWG No. 1A

APPENDIX G

WASTE CHARACTERIZATION REPORT

OceanChem group

Consultants in Chemistry to the Environmental and Earth Sciences

SUITE 32
1000 WINDMILL ROAD
DARTMOUTH, NOVA SCOTIA
B3B 1L7
TELEPHONE (902) 463-0114
FAX (902) 466-5743

2846
April 29, 1988

Mr. Wayne J. Smith, C.E.T.,
Conestoga-Rovers & Associates Limited,
651 Colby Drive,
Waterloo, Ontario.
N2V 1C2

RE: CHARACTERIZATION OF SARNIA/INGERSOL SAMPLES, REF.# 2299

Dear Mr. Smith;

We have completed the characterization of the following samples received from you;

OceanChem Sample Number	Sample Description
1770	Sarnia Coal Tar, 03-14-88, BH 4, (6 ft.) Pesticide, (coal Tar)
1771	Sarnia Coal Tar, 03-14-88, OW5-88, (7 ft.) Pesticide, (coal tar)
1772	BH 5-88, Ingersol
1773	Ingersol Coal Tar, 03-29-88, BH12-88, (11 ft.)
1774	Ingersol BH3-88, CS#5, (25 ft.)

All samples were characterized by capillary gas chromatography, with flame ionization detection.

Sample #s 1770, 1771, (Sarnia)

A high degree of overall similarity was observed in both samples. The majority of components in both samples appear to be aromatic hydrocarbons (most likely both alkylated and non-alkylated polynuclear aromatic hydrocarbons, (PAH). With reference to a detailed pattern comparison, 13 major components were observed in both samples with retention times within +/- 1%. There is therefore a high degree of likelihood that the hydrocarbon fraction of the samples originated from a common source.

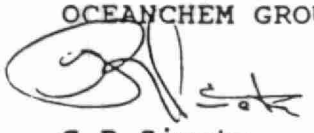
Sample #s 1772, 1773, 1774, (Ingersol)

In general, a high degree of chromatographic pattern similarity was observed in all three samples. Similar to the above Sarnia samples, #s 1770, and 1771, the capillary gas chromatographic data of the Ingersol samples is consistent with the presence of both alkylated and non-alkylated polynuclear aromatic hydrocarbons (PAH). A high degree of similarity was observed in all three samples, however sample # 1774 (BH-3), contained several early eluting compounds, not observed in sample #s 1772 (BH-5), and 1773 (BH-12). Although the identity of these compounds has not been established by confirmatory techniques such as capillary gas chromatography/mass spectroscopy, (GC/MS), the identity of these additional early eluting compounds appears to be consistent with the presence of polynuclear aromatic hydrocarbons, (PAH).

In conclusion, both sets of samples appear to contain a majority of PAH, and within each set, (geographic location), most likely originate from a common source.

If you have any questions, or require any additional information, please do not hesitate to contact me.

Yours truly,
OCEANCHEM GROUP



G.R.Sirota
Senior Project Manager

GRS.lb

cc. Ms.Chris Galinski
Mr.Paul Plotz

APPENDIX H

ANALYTICAL REPORTS

2299

NOVALAB LTÉE LTD

9420 CÔTE DE LIESSE, LACHINE, QUÉ. H8T 1A1

TÉL.: (514) 636-6218, 631-1838
TÉLEX: 05-822787 • (LYNJON)
FAX: (514) 631-9814

TO: Conestoga-Rovers & Associates Ltd
86 Rankin Street
Waterloo, Ontario
N2V 1C2

Attention: Mr. W. Smith

DATE: April 20, 1988

CLIENT ORDER #: 2299

REPORT #: NL-3513

RE: Analysis of Water Samples for MAH, Naphthalene, and Benzo(a)Pyrene - Project 2299

Sir,

Twelve (12) water samples, received March 25, 1988, were analysed for monocyclic aromatic hydrocarbons by purge and trap gc/ms (EPA method 624), and for indicator polycyclic aromatic hydrocarbons (naphthalene and benzo(a)pyrene) by gc/ms equipped with a mass selective in the single ion monitoring mode (EPA method 625). Due to a computer problem in which the data for the first analysis was lost, samples "Ingersoll #2" to "Ingersoll #6" had to be analysed a second time for MAH. The results presented here are from that second analysis. Duplicates for "Ingersoll #1" and the trip blank were also analysed. These duplicates showed a slight increase in toluene which may be due to contamination incurred after the initial sampling.

Chromatograms will be kept on file.

Sincerely,

NOVALAB LIMITED

B.E. Crowley, B.Sc.

Approved by J.D. Fenwick, Ph.D., P.Chem.

BEC/hl
encl.

CONCENTRATION OF MONOCYCLIC AROMATIC HYDROCARBONS IN WATER

ug/L

COMPOUND	OW5 Sarnia #40	MDL	OW2 Sarnia #10	OW1 Sarnia #20	OW3 Sarnia #30	OW3DUP Sarnia #50	OW3 Ingers. #1	OW4 Ingers. #2	OW2A Ingers. #3	OW1 Ingers. #4	MDL
BENZENE	810	10	-	-	2	-	-	27	2.3	TR	2
CHLOROBENZENE	-	10	-	-	-	-	-	-	-	-	2
1,2-DICHLOROBENZENE	-	10	-	-	-	-	-	-	-	-	2
1,3-DICHLOROBENZENE	-	10	-	-	-	-	-	-	-	-	2
1,4-DICHLOROBENZENE	-	10	-	-	-	-	-	-	-	-	2
ETHYLBENZENE	310	10	-	-	-	-	-	7.7	-	-	2
A-METHYLSTYRENE	-	10	-	-		-	-	-	-	-	2
METHYLSTYRENE ISOMERS	-	10	-	-	-	-	2.4	2.7	-	-	2
MESITYLENE	-	10	-	-	-	-	-	-	-	-	2
TOLUENE	47	10	-	-	3.6	4.3	-	8.5	6.3	TR	2
M+P-XYLENE	140	10	-	-	-	-	-	5.8	-	-	2
O-XYLENE	150	10	-	-	-	-	-	18	-	-	2
OTHER AROMATIC COMPOUNDS	540	10	-	-	11	12	6.8	49	-	-	2
STYRENE	TR	10	-	-	-	-	-	-	-	-	2

CONCENTRATION OF MONOCYCLIC AROMATIC HYDROCARBONS IN WATER

ug/L

COMPOUND	Boiler Ingers. #5	Trip Blank	Lab Blank	OW3 DUP Ingers. #6	OW3 DUP (duplicates) Ingers. #1	Trip Blank	MDL
BENZENE	TR	-	-	TR	TR	TR	2
CHLOROBENZENE	-	-	-	-	-	-	2
1,2-DICHLOROBENZENE	-	-	-	-	-	-	2
1,3-DICHLOROBENZENE	-	-	-	-	-	-	2
1,4-DICHLOROBENZENE	-	-	-	-	-	-	2
ETHYLBENZENE	-	-	-	-	-	-	2
A-METHYLSTYRENE	-	-	-	2	2	-	2
METHYLSTYRENE ISOMERS	-	-	-	-	-	-	2
MESITYLENE	-	-	-	-	-	-	2
TOLUENE	3.8	3.5	-	4.4	5	11	2
M+P-XYLENE	-	-	-	-	-	-	2
O-XYLENE	-	-	-	-	-	-	2
OTHER AROMATIC COMPOUNDS	-	-	-	6.9	7.2	-	2
STYRENE	-	-	-	-	-	-	2

MDL = METHOD DETECTION LIMITS

OTHER AROMATIC COMPOUNDS = Total concentration of trimethylbenzenes using the response factor of mesitylene.

CONCENTRATION OF NAPHTHALENE AND BENZO(A)PYRENE IN WATER SAMPLES

ug/L

	SAMPLE	Napnthalene	Benzo(a) Pyrene	Surrogate Standard Recovery (%) d8- Naphthalene	d12- Perylene
	Trip Blank	TR	-	70.4	60.3
ow2	Sarnia #1	0.1	-	68.6	51.5
ow1	Sarnia #2	0.1	-	71.3	55.3
ow3	Sarnia #3	100	1.3	64.8	42.6
ow3 DUP	Sarnia #5	46	1.3	92.6	57.5
ow3	Ingersoll #1	50	-	77.5	88.3
ow4	Ingersoll #2	* 112	-		63.6
ow2A	Ingersoll #3	* 2	-		52.3
ow1	Ingersoll #4	0.05	-	76.1	56.6
Bailer	Ingersoll #5	0.1	-	63	72.3
ow3 DUP	Ingersoll #6	37	-	60	62.2
	Lab Blank	0.05	-	64.1	69.6
	Detection Limits	0.05	0.05		
ow5	Sarnia #4	370	14	84.5	36.4
	Detection Limits	5	5		

* = Due to low d8-naphthalene extraction recovery, these values are calculated from the purgeables analysis data.

beak analytical services
A division of Beak Consultants Limited

14 Abacus Road
Brampton, Ontario
Canada L6T 5B7

Tel: (416) 458-4044
Fax: (416) 458-7303

report of analysis

Rec'd CRA

To: Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario
N2V 1C2

Project No.: 9529
Date Received: 88.03.25
Date Analyzed: 88.04.15
No. of Samples: 12 (4128)
Sample Type: Groundwater
Reference: #2299
Sarnia/Ingersoll

APR 27 1988

Attention: Ms. Debra Hayes

BAS REF #		Ing. OW3 T9665	Ing. OW4 T9666	Ing. OW2A T9667	Ing. OW1 T9668	Ing. Boiler T9669
SAMPLE DESCRIPTION		#1	#2	#3	#4	#5
PARAMETER	UNIT					
TOC	mg/L	1.5/1.5	3.5	1.5	1.5	3.0
DCP Scan:	mg/L					
Zinc		0.11	0.03/0.04	0.04	0.08	<0.01
Cadmium		0.0001	<0.0001	<0.0001	<0.0001	<0.0001/<0.0001
Manganese		0.59	0.62/0.63	1.68	0.57	<0.01
Cobalt		0.02	0.01/0.01	0.02	0.02	<0.01
Copper		0.020	0.030/0.030	0.065	0.055	<0.005
Iron		0.02	<0.02/<0.02	<0.02	<0.02	<0.02
Lead		<0.001	<0.001	<0.001	<0.001	0.008/0.009
Chromium		0.01	<0.01/<0.01	0.01	0.01	<0.01
Nickel		0.02	<0.01/<0.01	0.01	0.01	<0.01
Beryllium		<0.01	<0.01	<0.01	<0.01	<0.01/<0.01
Molybdenum		0.08	0.03	0.09	0.07	<0.01/<0.01
Calcium		180	109	167	182	0.20/0.20
Vanadium		0.015	0.005	0.015	0.015	<0.005/<0.005
Aluminum		0.20	0.14	0.18	0.20	<0.02/<0.02
Magnesium		38	18.2	37	34	<0.05/<0.05
Barium		0.17	0.05	0.23	0.20	<0.01/<0.01
Potassium		17.1	9.0	15.8	19.4	<0.05/<0.05
Strontium		2.9	0.60	4.4	2.1	<0.01/<0.01
Sodium		100	15.5	240	86	<0.5/<0.5

Approved

beak analytical services
A division of Beak Consultants Limited

14 Abacus Road
Brampton, Ontario
Canada L6T 5B7

Tel: (416) 458-4044
Fax: (416) 458-7303

report of analysis

To: Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario
N2V 1C2

Attention: Ms. Debra Hayes

Project No.: 9599 Page 2
Date Received: 88.03.25
Date Analyzed: 88.04.15
No. of Samples: 12 (4128)
Sample Type: Groundwater
Reference: #2299
Sarnia/Ingersoll

		Ing. OW3(Dup)	Sarn. OW2	Sarn. OW1	Sarn. OW3	Sarn. OW5
BAS REF #		T9670	T9671	T9672	T9673	T9674
SAMPLE DESCRIPTION		#6	#10	#20	#30	#40
PARAMETER	UNIT					
TOC	mg/L	1.5	2.5	12.5/12.5	18.5	27
DCP Scan:	mg/L					
Zinc		0.10/0.10	0.39	0.11	0.10	0.06/0.05
Cadmium		0.0002	0.0001	0.0001	<0.0001	<0.0001
Manganese		0.60/0.60	0.14	0.21	0.33	0.31/0.31
Cobalt		0.02/0.02	0.01	0.02	0.02	0.02/0.02
Copper		0.020/0.020	0.060	0.020	0.015	0.005/0.005
Iron		0.02/0.02	<0.02	<0.02	0.34	0.24/0.24
Lead		<0.001	0.001	<0.001	<0.001	<0.001
Chromium		0.02/0.01	0.01	0.01	0.01	0.02/0.01
Nickel		0.02/0.02	0.01	0.01	<0.01	<0.01/<0.01
Beryllium		<0.01	<0.01	<0.01	<0.01	<0.01/<0.01
Molybdenum		0.07	0.04	0.04	0.04	0.05/0.06
Calcium		187	166	174	200	200/230
Vanadium		0.015	0.015	0.015	0.010	0.015/0.015
Aluminum		0.20	0.18	0.18	0.020	0.22/0.22
Magnesium		39	24	30	31	67/67
Barium		0.17	0.05	0.07	0.04	0.09/0.10
Potassium		17.6	4.0	5.7	5.5	9.9/10.0
Strontium		2.9	0.42	0.77	0.34	0.72/0.71
Sodium		102	28	38	12.5	26/26

Approved

beak analytical services

A division of Beak Consultants Limited

report of analysis

14 Abacus Road
Brampton, Ontario
Canada L6T 5B7

Tel: (416) 458-4044
Fax: (416) 458-7303

To: Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario
N2V 1C2

Project No.: 9599 Page 3
Date Received: 88.03.25
Date Analyzed: 88.04.15
No. of Samples: 12 (4128)
Sample Type: Groundwater
Reference: #2299
Sarnia/Ingersoll

Attention: Ms. Debra Hayes

		Sarn OWS(Oup)	Ing. & Sarnia
BAS REF #		T9675	T9676
SAMPLE DESCRIPTION		#50	TRIP BLANK
PARAMETER	UNIT		
TOC	mg/L	19.0	<0.5
DCP Scan:	mg/L		
Zinc		0.11	<0.01
Cadmium		0.0001	<0.0001
Manganese		0.33	<0.01
Cobalt		0.02	<0.01
Copper		0.015	<0.005
Iron		0.36	<0.02
Lead		0.001	0.001
Chromium		0.01	<0.01
Nickel		0.01	<0.01
Beryllium		<0.01	<0.01
Molybdenum		0.04	<0.01
Calcium		200	<0.05
Vanadium		0.010	<0.005
Aluminum		0.20	<0.02
Magnesium		31	<0.05
Barium		0.04	<0.01
Potassium		5.5	<0.05
Strontium		0.34	<0.01
Sodium		12.5	<0.5

NOTE: Unless otherwise instructed samples will be retained for three weeks following completion of analysis.

Approved

beak analytical services

A division of Beak Consultants Limited

14 Abacus Road
Brampton, Ontario
Canada L6T 5B7

Tel: (416) 458-4044
Fax: (416) 458-7303

report of analysis

To: Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario
N2V 1C2

Attention: Ms. Debra Hayes

Project No.: 9599 Page 4
Date Received: 88.03.25
Date Analyzed: 88.04.15
No. of Samples: 12 (4128)
Sample Type: Groundwater
Reference: #2299
Sarnia/Ingersoll

PARAMETER	UNITS	REFERENCE MATERIAL DESCRIPTION	TRUE VALUE	ANALYSED VALUE	DATE ANALYSED
TOC	mg/L	WP1284#3	6.1	6.8	88.04.18
	mg/L	WP1284#4	91.1	94.4	88.04.18
Zinc	mg/L	WP386	0.100	0.105	88.04.06
Cadmium	mg/L	WS378#3	0.0020	0.0020/0.0019	88.04.14
Manganese	mg/L	WS378#3	0.100	0.097	88.04.14
Cobalt	mg/L	WS378#3	0.100	0.096	88.04.14
Copper	mg/L	WS378#3	0.100	0.100	88.04.14
Iron	mg/L	WS378#3	0.100	0.101	88.04.14
Lead	mg/L	WS378#3	0.017	0.017	88.04.14
Chromium	mg/L	WS378#3	0.100	0.094	88.04.14
Nickel	mg/L	WS378#3	0.100	0.094	88.04.14
Beryllium	mg/L	WP386	0.100	0.097	88.04.07
Molybdenm	mg/L	WP686	5.0	4.93/4.99	88.04.07
Calcium	mg/L	WP686	5.0	4.88/4.98	88.04.07
Vanadium	mg/L	WP386	0.250	0.244	88.04.07
Aluminum	mg/L	ICAP-7	0.97	1.06	88.04.07
	mg/L	WP386	0.500	0.532	88.04.07
Magnesium	mg/L	WP686	0.5	0.50/0.50	88.04.07
Barium	mg/L	ICAP-7	0.97	0.99	88.04.07
	mg/L	WP386	5.0	4.98/4.94	88.04.07
Potassium	mg/L	ICAP-7	10.0	10.9	88.04.07
Sodium	mg/L	ICAP-7	0.86	1.0	88.04.07
	mg/L	WP686	1.0	1.2	88.04.07

Approved